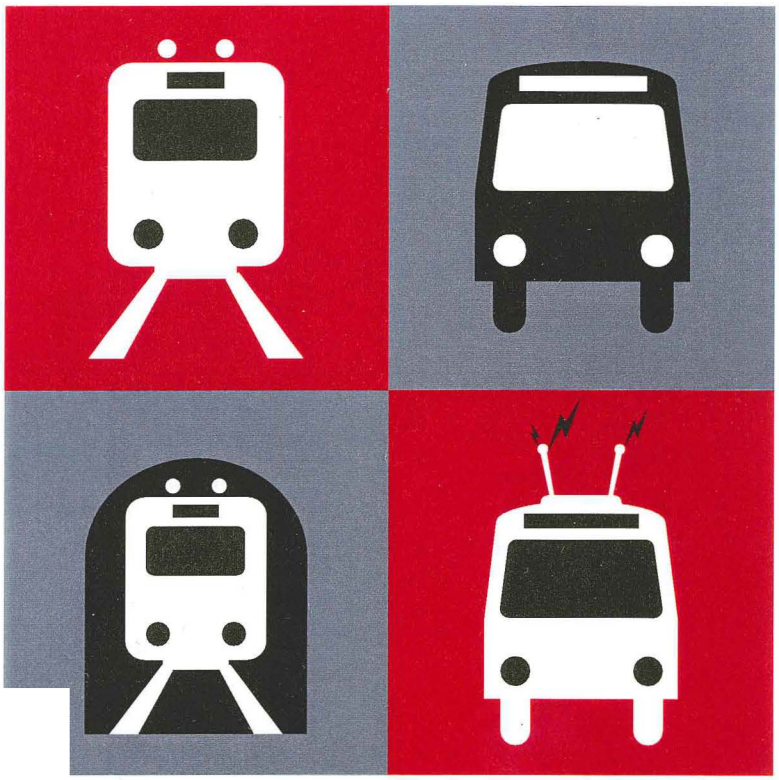
GEARY CORRIDOR

SYSTEM PLANNING STUDY



FINAL REPORT

PREPARED FOR

SA :O MUNICIPAL RAILWAY

BY MERRILL & ASSOCIATES

APRIL 1995

GEARY CORRIDOR

SYSTEM PLANNING STUDY

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PREPARED FOR

SAN FRANCISCO MUNICIPAL RAILWAY

BY **MERRILL & ASSOCIATES**

In Association With

Parsons Brinckerhoff Quade & Douglas
Kiyomura-Ishimoto Associates
Finger & Moy
Manna Consultants
Nelson/Nygaard Associates
Pittman & Hames Associates

APRIL 1995

GEARY CORRIDOR SYSTEM PLANNING STUDY

FINAL REPORT

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EXECUTIVE SUMMARY

I. INTRODUCTION

For many years there has been an interest in improving the speed, reliability and general quality of east/west transit service in the Geary Corridor.

Despite separate studies conducted by BART in the 1950s, the Golden Gate Bridge, Highway and Transit District in the early seventies, and by MUNI's Service Planning Department and the Geary Transit Task Force in 1988 and 1989, the Geary Corridor transit improvements have been limited to date, such as to the introduction of peak period express buses to better serve the outer western reaches of the corridor, and of peak period semi-exclusive bus lanes along Geary and O'Farrell east of Gough Street.

The reason for the continuing interest in making further improvements to Geary transit services stems from the heavy dependence of Geary Corridor travelers on public transit. The Geary Corridor is one of the most heavily used transit corridors in the United States. The one-way ridership of Corridor buses is over 118,000 per weekday. On Geary Boulevard alone, over 60,000 people per weekday board 38 and 38L Line buses.

If a way could be found to significantly speed up and otherwise improve Geary transit services, a great many people would benefit.

The Geary Corridor System Planning Study, funded through an allocation of Proposition B funds, is an outgrowth of the MUNI/Geary Transit Task Force Study and reflects the strong interest generated during the course of that study in changing the status quo in favor of a major investment directed toward the development of a Geary Corridor fixed guideway system.

II. STUDY ELEMENTS

The Geary Corridor System Planning Study began on August 30, 1993 and, with the submittal of the draft final report, was essentially complete by April 12, 1995. The study progressed generally as follows:

- As a first step in the process, a public participation program was designed under which interested parties and the general public were given opportunities to comment upon Consultant proposals and generally have input to the process throughout the course of the study
- An original list of 31 potential Geary Corridor transportation improvement alternatives was developed.
- During a subsequent screening period, participated in by affected public agencies and the public, the original list of candidates was reduced to seven alternatives which, on May 10, 1994, were selected by the San Francisco Public Utilities Commission for further development and evaluation.

To provide an analytical basis for comparing the seven selected alternatives to the existing condition and to each other, the Consultant developed a substantial amount of additional information including the following:

- technical descriptions and analysis
- operating plans
- one way trip times
- projected Year 2010 patronages vehicle requirements
- capital costs
- operating and maintenance costs
- environmental effects
- an assessment of available funding.

As a separate exercise, the effect of a BART Geary line on four of the selected Geary Corridor MUNI alternatives was evaluated. To facilitate the evaluation, the Consultant developed a separate set of BART capital costs, projected Year 2010 patronage and a summary of the key environmental effects of the BART alternative.

Based upon the information developed during the course of the study, including comments and other input received as a result of the public participation program, it was possible to further reduce the list of Geary Corridor MUNI-only alternatives to four. The results of the study as they relate to these four alternatives proposed for Public Transportation Commission and San Francisco County Transportation Authority policy approval, are summarized in the following section.

III. STUDY RESULTS

The Four Alternatives

The four Geary Corridor MUNI Alternatives can be summarized as follows:

- **Alternative 1 TSM**

This alternative consists of two variations; namely the No-Build Alternative and the Transportation Systems Management (TSM) Alternative. Under Alternative 1, the existing bus system would be retained and no major investment in the corridor would be made. Under the no-build variation buses would be added to meet demand. Under the TSM variation, in addition to the bus additions, certain low cost improvements designed to slightly speed up the service would be implemented. The benefits to be derived from this alternative are limited.

Alternative 1 is estimated to cost $33 Million in 1994 dollars.

- **Alternative 2 Subway Surface Light Rail** (with three east end routing options; one with subway from Laguna to the foot of Geary and O'Farrell and then on surface tracks to the foot of Market or to the Transbay Terminal, a second with subway from Laguna to Beale and Howard and a third with

subway from Laguna to the foot of Bush or Pine.

Under Alternative 2, light rail vehicles would travel in mixed flow traffic from 48th to 39th Avenues, in transit-only median from 39th to Laguna and, east of Laguna, in accordance with the options described above.

Depending upon which option is selected, Alternative 2 is estimated to cost between $654 Million and $899 Million in 1994 dollars.

- **Alternative 3 Subway Surface Electric Trolley Bus** (with two subway options; one extending from Laguna to Beale and Market and the other extending from Taylor to Beale and Market).

Under Alternative 3 electric trolley buses would travel in mixed flow traffic from 48th to 39th Avenues, in transit-only median from 39th to Laguna and, east of Laguna, in accordance with the options described above.

Depending upon which option is selected Alternative 3 is estimated to cost between $485 Million to $687 Million in 1994 dollars.

- **Alternative 4 All-Surface Light Rail**

Under Alternative 4, light rail vehicles would travel in mixed flow traffic from 48th to 39th Avenue, in transit-only median from 39th to Gough and on two-way, semi-exclusive surface lanes on Geary from Gough to Market and then on the surface tracks to the foot of Market or to the Transbay Terminal. Alternative 4 is estimated to cost $334 Million in 1994 dollars.

Comparison Factors:

Quantifiable data, as it applies to the four alternatives, is shown in Figure I.

Key Environmental Factors:

The four alternatives are located either underground or on public thoroughfares. For this reason, private property takes are not anticipated. In some cases it would be necessary to obtain subsurface easements and underpin existing structures to facilitate subway construction.

Key environmental impacts of the four alternatives are summarized as follows:

Light rail mixed flow operation: The impact would include the effects of an overhead trolley wire system and tracks. To install light rail tracks it would be necessary to relocate utilities underlying the trackway. Since the tracks would be located in the center of the street there is also a need to construct station platforms.

For the surface light rail section envisioned under Alternative 4 as extending eastward from Gough to the foot of Geary, there would be additional impact. To

remove enough traffic from this section of Geary to facilitate a reasonably efficient surface rail operation, it would be necessary to make a number of changes including reversing the direction of Post Street, relocating the entrance to the Union Square Garage, converting Sutter to a two-way traffic street and requiring right turns every other block along that section of Geary. Local parking and access would be maintained. New landscaping between Stockton and the foot of Geary could significantly improve the appearance of that section of Geary.

Transit-only Median Operation (bus or rail): To create the space necessary for a transit right-of-way, it would be necessary to replace portions of the existing landscaped median, convert the diagonal parking currently existing from 14th to 28th Avenues to parallel parking, remove one lane of traffic in each direction between Gough and Scott Streets, eliminate some of the left turn movements, etc. Street parking would be maintained at current levels. New pedestrian havens in the middle of the street, new landscaping in median and on sidewalks, and attractive station lighting would improve the appearance of Geary Boulevard.

Subway Operation (bus or rail): Most of the effects would be limited to the construction period. Between stations it may be possible to use tunneling techniques to minimize surface impact. However the construction of stations, portals and the Market Street crossing would necessarily require cut-and-cover construction, meaning that there would be major although relatively short-lived disruption along the affected sections.

Funding:

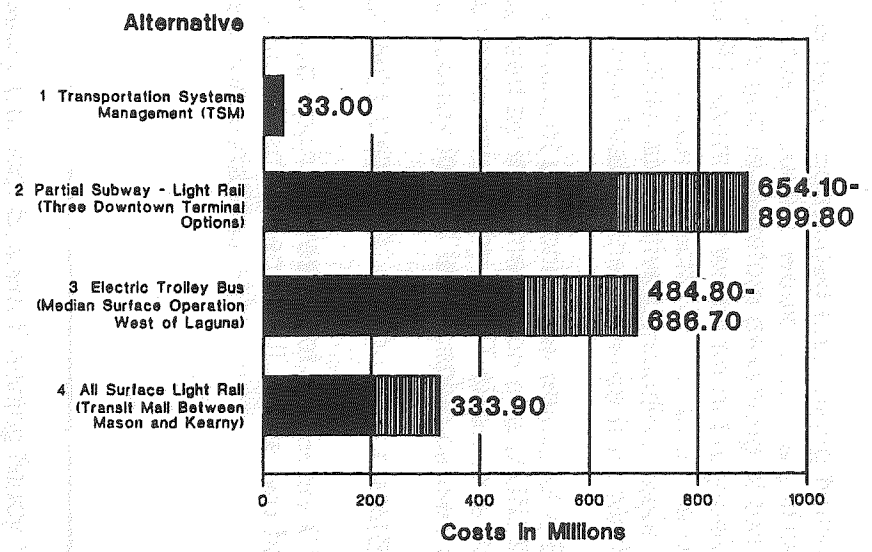
Competition for federal and state transportation funding is very high at this time. Much of the Bay Region's share of federal new start rail funds is currently allocated to BART extensions and to the Tasman Corridor light rail project. Because of the already high use of MUNI by Geary Corridor travelers, the proposed Geary Corridor fixed guideway improvements would not attract as many new riders to transit as would a new rail line extended to, say, Modesto. However, it is clear from the results of the study that a Geary Corridor rail or bus fixed guideway system of higher speed and reliability would significantly shorten the trip times and otherwise benefit the thousands of San Franciscans who currently use MUNI buses for their work and non-work Geary Corridor trips.

In the past, federal feasibility standards have emphasized the ability of proposed new rail lines to attract new riders. In recent years it has been recognized that this standard has tended to favor lines in low density suburban areas where virtually everyone drives at the expense of important urban corridors capable of generating much higher overall transit patronages.

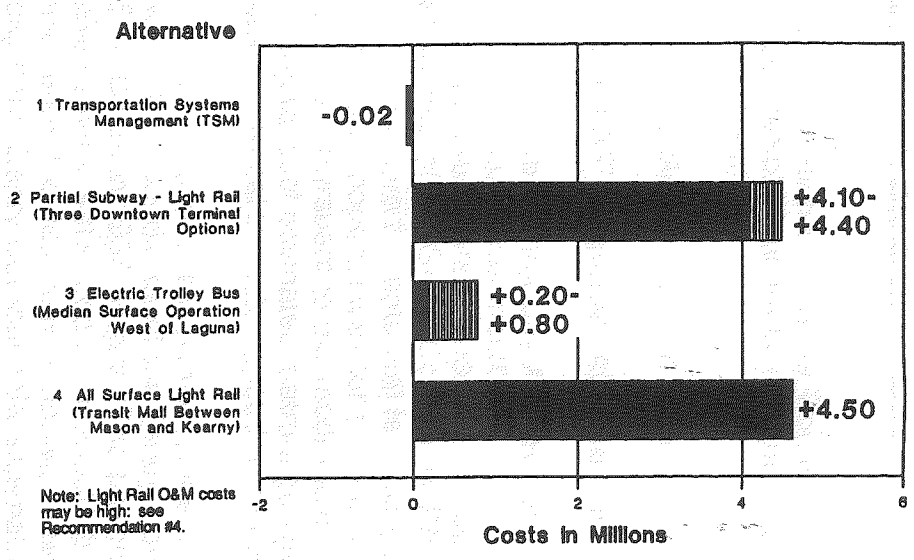
If, as appears likely, federal standards change in the near future to rectify this problem, a heavily patronized corridor like the Geary Corridor could become a prime candidate for major funding. However, with federal transportation development funds as scarce as they are today, it appears that early

Geary Corridor

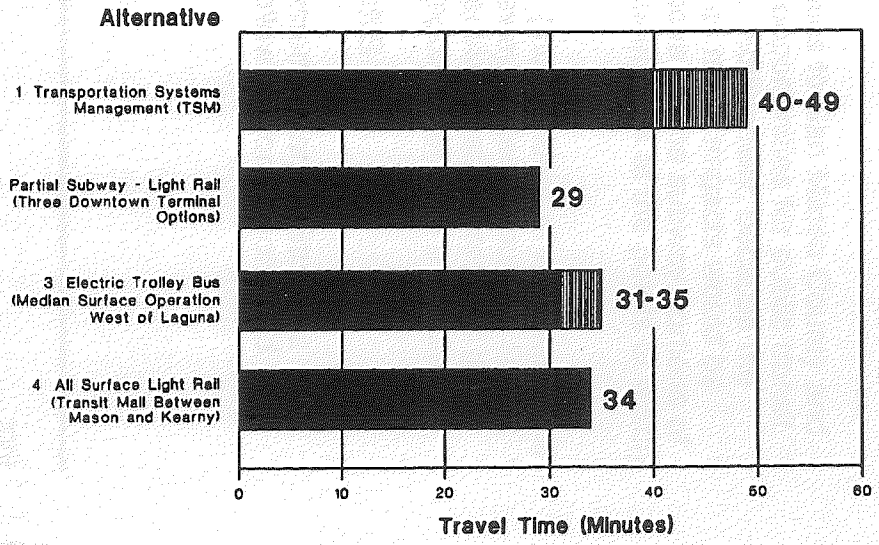
Comparison of Capital Costs



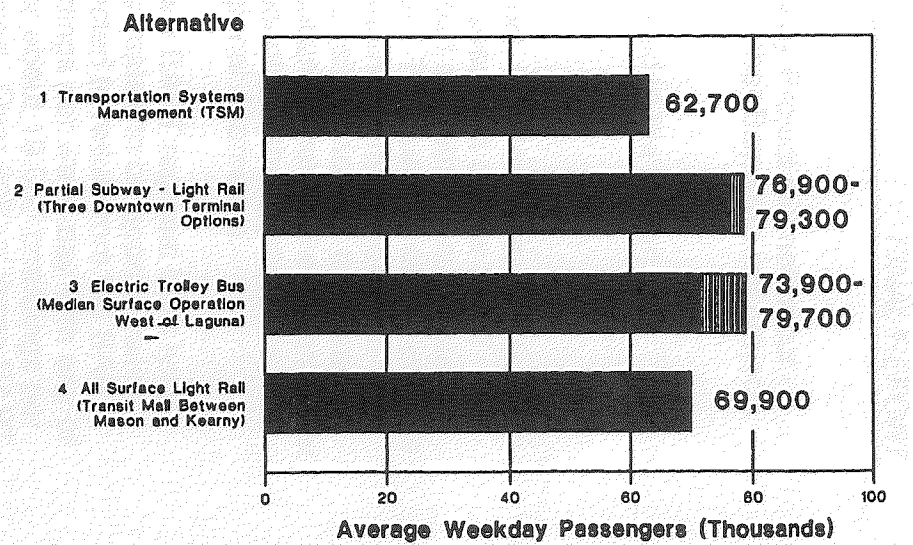
Comparison of Operating Costs



Comparison of Travel Times to Sansome and Market



Comparison of Daily Ridership - Year 2010



MUNI GEARY TRANSIT STUDY

Figure I

implementation of a Geary Corridor Fixed Guideway Project will not occur unless regional rail funds currently earmarked for other Bay Area rail projects are reallocated.

A funding plan for each of the alternatives is included in the Report.

The BART Regional Alternative:

At the request of the Bay Area Rapid Transit District, the Geary Corridor System Planning Study was modified to provide for an assessment of how BART regional lines running under Geary between Market and 6th Avenue would affect four of the Geary Corridor MUNI alternatives. The purpose of the analysis was to explore the potential feasibility of joint planning, construction, and operational opportunities for regional and local transit services in the Geary Corridor. Pursuant to the modification, the Consultant developed a separate set of capital cost estimates, patronage figures and identified the separate key environmental impacts caused by the BART Regional Alternative.

The capital cost of the portion of the proposed new BART regional lines lying within the boundaries of the Geary Corridor is estimated to be approximately $1.4 Billion in 1994 dollars. The patronage projected to result from the BART alternative is estimated to be about 18,000 boardings per week day with any of the Geary Corridor fixed guideway alternatives or about 19,000 boardings per day if the Geary Corridor TSM alternative is selected. Over 80% of these BART boardings would be travelers who would otherwise use MUNI for their Geary Corridor trips.

The report concluded that linking Northbay counties to San Mateo County and Eastbay counties would create significant travel opportunities for public transit users and is therefore deserving of further study. Additionally, because the BART alternative would be entirely below grade its major impacts would be construction impacts, similar to those outlined above for the subway portions of the MUNI alternatives, including major cut-and-cover work at the points at which the new branch lines diverge from Market Street.

Permanent environmental effects of a BART line (independent of what would be caused by implementation of a MUNI fixed guideway system) would be limited to those caused by BART sidewalk entrances, ventilation structures and the temporary loss of landscaping caused by the temporary removal of medians.

CONCLUSIONS AND RECOMMENDATIONS

Based upon the results of the Geary Corridor System Planning Study as summarized in Section III above, we have the following conclusions and recommendations:

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1. Need for Major Improvement of Geary Corridor Public Transit System. Because of:

- the very high public use of Geary Corridor buses despite the loss of time, reliability and comfort caused by their having to travel in mixed flow traffic lanes;

- the likelihood that the traffic and other adverse conditions which already make Geary Corridor bus travel a relatively frustrating and uncomfortable experience will worsen with time as the San Francisco Bay Region grows; and

- the preference of most of the people attending the 10 public meetings for a major investment which would result in a significant improvement in the reliability and general quality of Geary Corridor transit services

It is recommended that subject to the availability of funds, the City move ahead with a major capital investment to improve the Geary Corridor public transit service and that this improvement include significant reduction in public transit trip times as well as significant improvement in public transit reliability and patron comfort.

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2. Advancement into the Next Stage. As an outgrowth of comments received during the Public Participation Program, and based upon intensive screening by representatives of the San Francisco Transportation Authority, the City Departments of Parking and Traffic and City Planning, and MUNI as well as by representatives of the Bay Area Rapid Transit District and the Consultant team, the seven options described above were reduced in number and combined into the four alternatives defined above.

It is recommended that on behalf of meeting the objectives of Recommendation 1, the four alternatives be advanced at the appropriate time into the next (Major Investment Study) phase of the federal implementation and funding process.

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3. Patronage Forecasting. Projecting public transit patronage in San Francisco has been hampered for many years by the limited applicability of the Metropolitan Transportation Commission's (MTC's) forecasting model to this city.

At various times, various city departments have called for San Francisco either to work with MTC to better adapt the MTC model to San Francisco, or to develop a separate City of San Francisco model.

In any event, an accurate means of forecasting future public transit patronage is badly needed as a tool for evaluating the various public transit fixed guideway systems currently under consideration.

It is therefore recommended that a sophisticated patronage forecasting model that can be accurately applied to San Francisco County be developed forthwith.

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4. Costing Methodology. Each year MUNI submits a Section 15 Report to the Federal Transportation Administration delineating MUNI's annual operating and maintenance (O&M) costs. MUNI's 1993 costs as set forth in the latest Section 15 Report formed the basis of the Geary Corridor O&M cost estimates. During the course of the Geary study a concern arose over the accuracy of the Section 15 Reports.

It is therefore recommended that MUNI conduct an independent analysis of the Section 15 Report and make methodology adjustments as appropriate.

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5. The BART Regional Alternative. Pursuant to a resolution adopted by the BART Board of Directors on July 14, 1994, the effect of a BART Geary regional line on four of the proposed Geary Corridor MUNI lines was evaluated. The results of this BART-sponsored effort were set forth in a separate report entitled "The BART Regional Alternative: Its Effect on MUNI". Based upon the results of the BART study, it was concluded that:

- constructing a Geary branch of the BART system from Market Street, through the Geary Corridor to approximately Seventh Avenue, where BART would leave the Geary Corridor, would be insufficient to meet the needs of many Geary Corridor travelers, and therefore would not preclude the need for a separate MUNI fixed guideway system designed to improve Geary Corridor transit services;

- regional rail lines linking Northbay counties to San Mateo County and the Eastbay counties would create significant travel opportunities for public transit users and are therefore deserving of further study; and

- additional data and analysis are needed to fully identify the routing, feasibility, and patronage which could be generated by providing additional regional rail transit services in the Westbay and Northbay Counties.

It is therefore recommended that if BART is interested in improving regional transit connections on the north and west sides of San Francisco Bay, that it initiate a more definitive study designed to find the best way of extending its system, or otherwise serving the areas not now adequately served by BART.

INTRODUCTION

I. INTRODUCTION

For many years there has been an interest in improving the speed, reliability and general quality of east/west transit service in the Geary Corridor.

Despite separate studies conducted by BART in the 1950s, the Golden Gate Bridge, Highway and Transit District in the early seventies, BART again in the mid-seventies and by MUNI's Service Planning Department and the Geary Transit Task Force in 1988 and 1989, the Geary Corridor transit improvements to date have been limited mainly to the introduction of peak period express buses to better serve the outer western reaches of the corridor, and of peak period semi-exclusive bus lanes along Geary and O'Farrell east of Gough Street.

The reason for the continuing interest in making further improvements to Geary transit services stems from the heavy dependence of Geary Corridor travelers on public transit. The Geary Corridor is one of the most heavily used transit corridors in the United States. The one-way ridership of Corridor buses is over 118,000 per weekday. On Geary Boulevard alone, over 60,000 people per weekday board 38 Line buses.

If a way could be found to significantly speed up and otherwise improve Geary transit services, a great many people would benefit.

The Geary Corridor System Planning Study is a direct outgrowth of the MUNI/Geary Transit Task Force Study and the strong interest generated during the course of the study in changing the status quo in favor of a major investment directed toward the development of a Geary Corridor fixed guideway system.

ELEMENTS OF THE STUDY

II. ELEMENTS OF STUDY

A. Purpose and Scope of Study

The purpose of the Geary Corridor System Planning Study is to identify, screen, develop and evaluate alternative ways of improving public transit conditions in the Geary Corridor of San Francisco.

The study consists of identifying improvements to the existing surface bus system and of identifying and developing subway/surface rail alternatives, subway/surface electric trolley bus alternatives, all subway rail alternatives and all surface alternatives. Various routes and subway/surface combinations were considered. Special attention was paid to future extensions and connections to other corridors and transit systems within and adjacent to the study area.

The Products of the Study include:

Corridor Existing Conditions

Working Paper #1 Transportation Deficiencies and Land Use Linkages in the Geary Corridor

Working Paper #2 Goals, Objectives and Evaluation Criteria

Working Paper #3 Preliminary Alternatives

Working Paper #4 Technical Studies

Working Paper #5 Ridership Projections

Working Paper #6 Cost/Benefit Analysis

Working Paper #7 Land Use/Economic Impacts

Working Paper #8 Environmental Impact Assessment

Working Paper # 9 Potential Funding Sources

Working Paper #10 Public Participation Program and Comments

Final Report

B. Study Area

For the purposes of this study, the Geary Corridor has been defined as a half–mile wide band with Geary Boulevard at the center, extending from 48th Avenue on the West to the Bay on the East. The northern boundaries of the Corridor are, from the West, California Street to Presidio Avenue, Pine Street to Kearny, then Sacramento to Drumm, Drumm to Market, and Market to the Bay. The southern boundaries from the West are Balboa Street to Arguello Boulevard, Turk Street to Market, Fifth to Howard, and Howard to the Bay. See Figure 1.

For purposes of analyzing land use and census data, a somewhat larger area was used by the Department of City Planning. It should also be noted that certain important transit routes located partly outside the study area were kept in the analysis to ensure good conductivity with other transit services.

C. Getting Started

On July 27, 1993, the San Francisco Public Utilities Commission (SFPUC) retained Merrill & Associates (M&A) assisted by subconsultants:

Parsons Brinckerhoff Quade & Douglas;
Pittman & Hames;
Manna Consultants, Inc.;
Manuel Padron & Associates;
KI Associates;
Finger & Moy;
the SFPUC's Utilities Engineering Bureau
(now called the MUNI Capital Engineering); and
The City Planning Department

to conduct the Geary Corridor System Planning Study.

Pursuant to the SFPUC action, the M&A team received its final Notice to Proceed from the MUNI Service Planning Department on August 30, 1993.

One of the first steps taken by M&A and its outreach subconsultant, KI Associates, working closely with the MUNI Service Planning Staff was to develop a Public Participation Program (see Section II E below).

Study Project Area

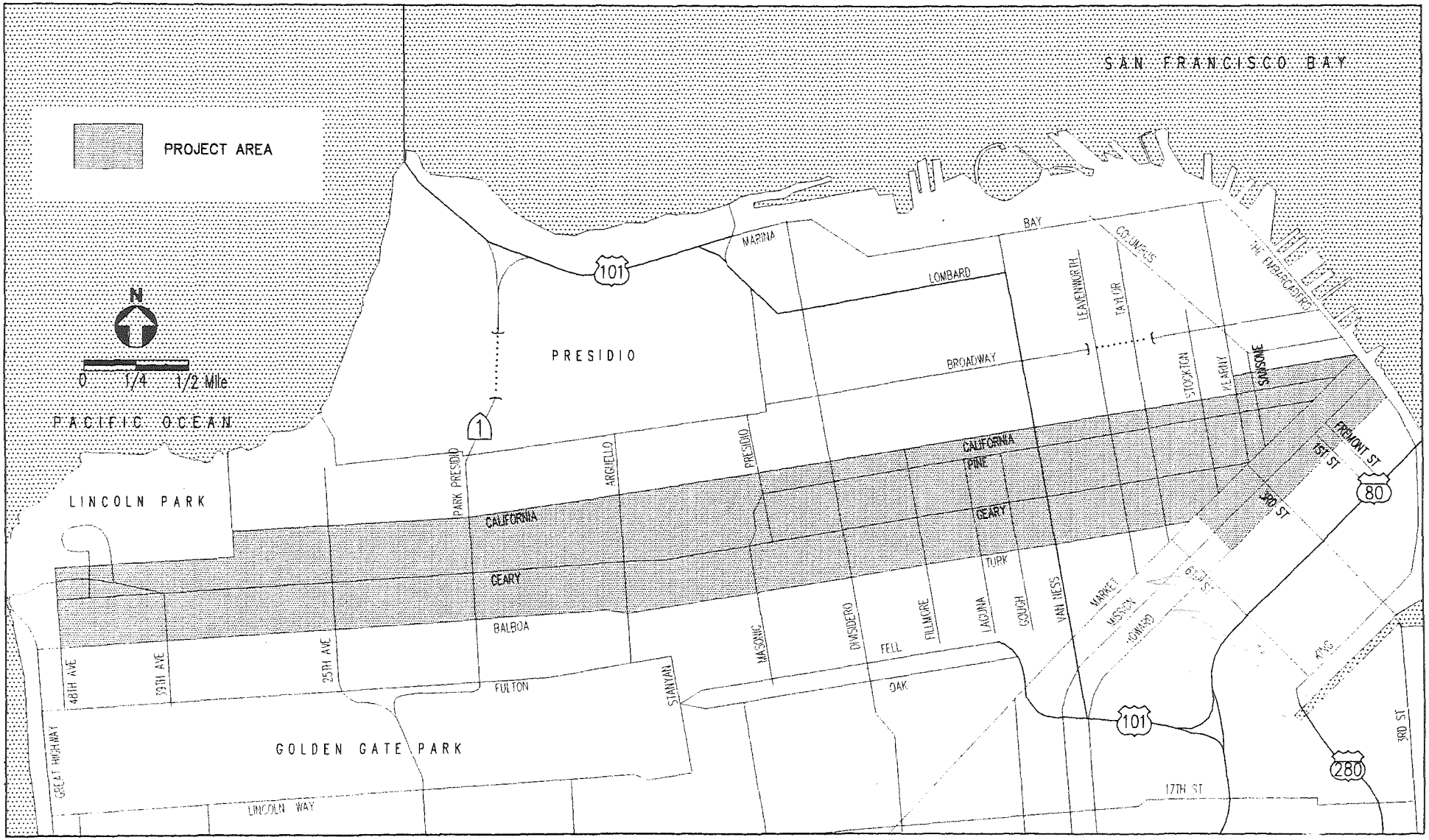


Figure 1

MUNI GEARY TRANSIT STUDY

D. Existing Transportation Conditions

As indicated above, the Geary Corridor extends 7 miles from the Pacific Ocean on the West to the San Francisco Bay on the East.

Public transit already plays a very important role in meeting the needs of Geary Corridor travelers. The 38 Geary and 38L Geary Limited buses currently carry 52,000 one way riders per day, making Geary one of the busiest public transit streets in the country. The total current boardings of the twelve east/west bus lines (MUNI Routes 1, 1AX, 1BX, 2, 5, 31, 31AX, 31BX, 38, 38L, 38AX and 38BX) now serving the Geary Corridor stands at 130,600 boardings a day, 7 times the number served by many light rail systems across the nation.

MTC patronage data shows that about 24.8 percent of travel in the Geary Corridor is by transit. For commute travel, the figure is much higher. An estimated 38.4 percent of Geary Corridor work trips are by transit. For work trips between the Geary Corridor and downtown San Francisco (the financial district), the proportion of transit users is estimated to be as high as 80-85 percent.

There are a variety of reasons for this heavy use of the MUNI by Geary Corridor residents and other travelers. The scarcity and expense of automobile parking in San Francisco is certainly a factor. So is the relative population density of the residential areas along the route and the many small businesses located on and immediately adjacent to Geary. The relative efficiency of the Geary bus services in taking travelers directly into the heart of downtown San Francisco, as well as to other important destinations, is another important factor causing people to opt for MUNI over their private automobiles for many trips.

Despite its relatively heavy patronage, the surface bus operation is severely impeded by traffic congestion as well as by intersection stops and loading delays. For these reasons, the average speed of a bus traversing the Geary Corridor is only 9 m.p.h. (for MUNI Route 38). Speeds are higher in the outer part of the Corridor, averaging about 11 m.p.h., but in the inner Corridor (east of Van Ness), speeds range from 5 to 7 m.p.h. (or about the same speed as a fast walk or jogging). During particularly heavy traffic days, speeds can be even slower.

Speed is not the only variable affected by the above "impedance" factors. Traffic and patron loading conditions vary throughout the day and therefore are not predictable. The unpredictability of the conditions affecting a bus as it travels through the city on mixed flow traffic lanes makes it virtually impossible to hold a precise schedule, thus adversely affecting the reliability of the service.

Other factors which must be considered when evaluating the current transportation condition of the Geary Corridor include the uncomfortable and tiring effect, particularly on standees, of buses that must constantly slow down and speed up as traffic conditions vary, and that must swing into and out of curbside bus stops.

Moreover, given the projected steady increase in the population of the Richmond District of San Francisco, and of the San Francisco Bay Region generally, it can be predicted with certainty that the delays and unreliability experienced by Geary bus riders today will gradually worsen with time unless:

- steps are taken to reduce loading delays
- transit vehicles are permitted to move on their own right-of-way independently of surrounding traffic conditions

For additional information about transportation deficiencies, see Working Paper #1.

E. Public Participation Program

The Study Team anticipated a high level of interest by all groups in the Corridor. The history of study and transit improvement efforts in the Geary Corridor indicated several issues that must be addressed, including concerns regarding system integration, transit-generated development, loss of parking, construction impacts & mitigation, station spacing, walking distances, travel times, service reliability, and over-crowded transit vehicles.

The goals of the Public Participation Program were to:

- Identify individuals and organizations representing the range of public transit ridership and interests in the Corridor, with efforts targeting hard-to-reach communities such as immigrants, ethnic minorities, and business (small and large; neighborhood, downtown and international);
- Solicit and receive input on transit alternatives from affected individuals and organizations through an outreach campaign that includes media releases, various forms of community outreach, and direct contact with interested parties;
- Develop and disseminate information on transit issues and study alternatives that was responsive to the interests of transit users;
- Inform policy boards and city agencies of public outreach and results during the study; and
- Keep an open mind.

In coordination with MUNI Service Planning staff, the team developed a public participation process designed to involve Geary Corridor stakeholders early and throughout the study. All activities related to this task, including development of the program, were developed with the advice and guidance of

the Geary Sub-committee of the Citizen's Advisory Committee of the San Francisco County Transportation Authority (SFCTA).

Major elements of the Public Participation Program included:

1. **Public Meetings:** Public meetings were held at key stages of the study. Each meeting was designed to communicate and to receive input on both the general direction of the study, and on specific issues being considered by the study team at that particular time. A summary of the public meetings is presented in Figure 2.

   Special efforts were made to reach the diverse communities which make up the Geary Corridor. These included concentrated outreach efforts to Asian and African American communities in the Corridor, directly and through ethnic media outlets. They also included providing for Chinese language (and other language) services, including a meeting for Cantonese speakers. Parallel efforts were directed at business, employers, public service providers, and non-residential users (e.g., universities, shopkeepers and restauranteurs). These included, at the request of several trade group executives, a February 10, 1994 special briefing held at the SPUR conference room to acquaint them with the study and its objectives.

   For each meeting, an agenda was prepared and distributed, which typically included opening remarks and a project overview by the Study Team and MUNI Service Planning staff, discussion of specific issues with the perspective of the neighborhood or community foremost in mind. Newsletters and handouts were available at each meeting at a literature table, on which participants were also allowed to place their own materials. Overhead projectors and poster boards were used to illustrate the commentaries.

2. **Special Meetings:** MUNI Staff also participated in a number of special meetings. Fifteen meetings were held by request of organizations such as the Geary Merchants Association and the Golden Gate Democratic League. Generally, MUNI Staff would make a presentation and answer questions, as one item on the organization's agenda for that meeting.

   Three presentations were made to the Transportation Authority's CAC (Citizens Advisory Committee).

   Nine presentations were made to the TAC (Technical Advisory Committee).

   Three meetings were held with BART Staff, for the purpose of negotiating the inclusion of the BART Alternative in the Study.

Meetings were also held with the Public Transportation Commission (PTC), to discuss screening recommendations, BART's involvement in the Study, and the decision regarding the final recommended alternatives.

3. **Public Surveys:** Three surveys were administered, including:

   a. "Transportation Concerns Identification Workbook," a questionnaire in workbook format distributed at the November 1993 General Meeting, with scenarios regarding existing transit conditions on the Geary Corridor;

   b. A three-question survey, distributed in the December 1994 round of public meetings, asking attendees whether MUNI should invest in one of the seven transit alternatives; if so, which mode did they prefer, and which alternative did they prefer; it also asked for any comments the respondents might offer; and

   c. A three-question survey in the March 1995 newsletter, asking readers to tell MUNI whether it should invest in one of the four final transit alternatives; if so, which mode did they prefer, and which alternative did they prefer; this was also administered to the attendees of the March 1995 general meeting.

4. **Newsletters:** Four newsletters were published and distributed throughout the study. Dubbed the ***Geary Express***, the first issue was drop delivered to all residences in the Corridor, a distribution of approximately 30,000 issues. All four issues were sent by first-class mail to the mailing list (which began at over 500 and grew to over 600 by the fourth newsletter); in addition, the second issue was sent by the Planning Association for the Richmond (PAR) and the Geary Merchants Association to several hundred of their members. The third issue was also sent by the Union Square Association to 130 of its members. The third and fourth newsletters were also distributed on selected MUNI lines running in or through the Corridor. Copies were also made available at the meetings and at the San Francisco Planning and Urban Research Association (SPUR) conference room.

5. **Bus Tour:** A guided tour of the study area was conducted for about 40 Corridor business leaders, residents, and interested citizens, on October 8, 1994.

6. **Media Relations:** Notices of public meetings and articles about the study were developed and published in local newspapers.

7. **Mailing/Fax Lists:** Comprehensive mailing/fax lists containing interested individuals, community and business groups and leaders, and media representatives were prepared and maintained throughout the study.

8. **Direct Contact:** At various times in the study, residents contacted study team members by phone or by mail to convey their ideas and beliefs about the study.

Figure 2

Meeting/Activity Chart

Date	General meeting	Community meeting	Special meeting	Newsletter
October 21, 1993			TAC	
November 1993				Geary Express #1
November 16, 1993	Roosevelt Middle School*			
January 26, 1994			CAC	
January 27, 1994			TAC	
February 8, 1994			Golden Gate Democratic League	
February 10, 1994			Downtown Business Representatives	
March 1994				Geary Express #2
March 1, 1994		Downtown/Business		
March 1, 1994			Sutro Heights Neighborhood Group	
March 14, 1994		Japantown/Western Addition/Tenderloin		
March 15, 1994		Chinese Community (in Cantonese)		
March 21, 1994		Richmond District		
March 31, 1994			TAC	
April 14, 1994			TAC	
April 21, 1994			South of Market Groups	
April 27, 1994			CAC	
April 28, 1994			S.F. Planning and Urban Research (SPUR)	
May 10, 1994			PTC	
May 24, 1994			BART Engineering and Operations Committee	
May 25, 1994			TAC	
May 26, 1994			BART Board	
June 14, 1994			PTC	
July 7, 1994			TAC	
July 12, 1994			Geary Merchants Association	
July 14, 1994			BART Board	
July 25, 1994			Planning Association of the Richmond (PAR)	
July 26, 1994			PTC	
August 16, 1994			Richmond Democratic Club	
September 13,1994			PTC	
October 8, 1994			Bus Tour	
November 1994				Geary Express #3
November 10, 1994			TAC	

Meeting/Activity Chart (con't)

Date	General meeting	Community meeting	Special meeting	Newsletter
November 15, 1994			Chinatown TRIP	
November 19, 1994			Richmond Neighborhood Coalition	
December 1, 1993		Tenderloin/Western Addition/Japantown **		
December 6, 1994		SPUR: Business **		
December 7, 1994		Richmond District **		
January 19, 1995			Union Square Merchants Association	
January 26, 1995			TAC	
January 31, 1995			SPUR	
February 16, 1995			TAC	
February 22, 1995			CAC	
March 1995				Geary Express #4**
March 9, 1995			Geary Merchants Association	
March 13, 1995	Roosevelt Middle School**			
March 22, 1995			CAC	
April 19, 1995			Downtown Association	
April 24, 1995			PAR	
April 25, 1995			PTC	

* Included Workbook **Included Survey

For additional information about the public participation program, see Working Paper #10.

F. Goals and Objectives

The following set of Study goals and objectives has been extracted and combined from a more comprehensive list developed by the San Francisco Department of City Planning and set forth in its entirety in Working Paper #2.

The attached summary has been developed with consideration given to the issues identified and emphasized by members of the public during the Public Participation Program:

Goal #1:
Improve transit service to, from, within and through the Corridor.

- Reduce trip times along the Geary Corridor.
- Provide access to the central business district.

Goal #2:
Implement a project that enhances equity in access to transportation services.

- Provide access to persons with disabilities.
- Distribute transportation benefits based on social equity.
- Develop ideas in response to input from affected communities.

Goal #3:
Improve transportation opportunities in the Corridor while avoiding pressure to stimulate unwanted growth.

- Provide access to areas within the Corridor where business activity is high and vital.
- Provide service to areas needing economic stimulus/revitalization.
- Enhance pedestrian activities.

Goal #4:
Enhance environmental conditions in the Corridor and the City.

- Minimize vibrations impacts.
- Minimize impacts on historic structures and park lands.
- Minimize noise and emissions by transit vehicles operating in the Corridor.
- Minimize impact on parking.
- Enhance visual and urban design elements.

Goal #5:
Enhance, facilitate and coordinate with current and planned city and regional transportation systems.

- Improve linkages to other transit services and facilities.
- Minimize conflicts with other traffic.
- Minimize impacts on traffic lanes.

Goal #6:
Implement a cost effective and financially feasible system.

- Minimize construction cost.
- Seek to match proposals to available funds.

Goal #7:
Implement improvements that are sound and feasible from an engineering viewpoint.

- Minimize impacts on MUNI Metro, surface streetcar and BART operations.

Goal #8:
Implement project in a timely fashion.

- Develop ideas in response to input from affected communities.
- Minimize construction time.
- Consider potential for staged development.

G. Initial Evaluation and Screening

The objective of the Screening Process was to identify a relatively long list of Geary Corridor alternatives and then, through qualitative analysis and discussion, to reduce the number of candidates to no more than seven deemed suitable for further study and evaluation.

This reduction occurred in two steps.

Reducing the Initial List.

During fall of 1993, an initial list of thirty-one possibilities was developed. Comments from the public at the first Corridor-wide public meeting, on November 16, 1993, provided input into this development process. In early discussions among Study Team members this initial group of possibilities was reduced to eighteen. For a description of the initial list and a summary of why certain of the alternatives included on the initial list of 31 were deemed to be impractical and therefore dropped from further consideration, see Appendix A.

Screening and Evaluating the Eighteen Candidates.

To give all concerned parties an opportunity to have input to the evaluation process, the eighteen remaining candidates were presented first at a CAC meeting on January 26, 1994, then at a TAC meeting on January 27, 1994 and finally at public meetings held on March 14, 15 and 21, 1994.

After the M&A team (together with representatives of MUNI, the Department of City Planning, the Department of Traffic and Parking and the Utilities Engineering Bureau) had thoroughly discussed and evaluated the eighteen initial candidates and considered the comments received from the TAC, the CAC and the public, formal screening of the eighteen candidates took place during three lengthy meetings held March 22, 23 and 25, 1994 in the Main Conference Room of Parsons Brinckerhoff.

Screening consisted of a comprehensive discussion of the pros and cons of each candidate followed by a numerical rating of the alternatives based upon the Study Goals, Objectives and Evaluation Criteria developed by the Department of City Planning and presented in Working Paper #2.

The eighteen candidates are listed as follows:

- No Build (combined with TSM)
- Transportation Systems Management (combined with No Build)

- Full Subway BART (dropped)
- Partial Subway Light Rail (subway from Laguna to Kearny and Bush) (dropped)
- Partial Subway Light Rail (subway from Laguna to Union Square) (kept)
- Partial Subway Light Rail (subway from Laguna to the foot of Post) (dropped)
- Partial Subway Light Rail (subway from Laguna to Third and Bryant) (dropped in favor of Beale and Howard terminal with connection to Bayshore line)
- Partial Subway Light Rail (subway from Laguna to separate portals on Third and Fourth) (dropped in favor of Beale and Howard terminal with connection to Bayshore line)
- Electric Trolley Bus (mixed flow west of Laguna) (kept)
- Dual Mode Bus (mixed flow west of Laguna) (dropped)
- Electric Trolley Bus (median surface operation west of Laguna) (kept)
- Dual Mode Bus (Electric Trolley Bus Laguna) (dropped),
- Electric Trolley Bus (mixed flow west of Taylor) (dropped)
- Dual Mode Bus (mixed flow west of Taylor) (dropped)
- Electric Trolley Bus (median surface operation west of Taylor) (kept)
- Dual Mode Bus, with semi-exclusive lanes in downtown entering subway (dropped)
- All surface line, Light Rail or Bus (dropped)
- All surface line, Light Rail or Bus, Transit Mall between Mason and Kearny (kept as Light Rail line)

Following is a brief discussion of how the list of eighteen candidates was reduced to the seven selected for further study and evaluation:

The No Build alternative and the TSM alternative were combined. Since the TSM alternative involved only relatively non-controversial features of relatively

low cost (i.e. replacement of worn out buses with low floor vehicles and pre-empted signals where appropriate), it was decided that, for comparison purposes, it would be acceptable to delete the No Build alternative.

The Full BART Subway alternative was dropped because of its high capital cost and inability, because of infrequent BART station stops, to serve Geary Corridor local needs.

The alternative encompassing a Light Rail (LRT) subway from Laguna to Kearny and Bush was dropped because it would not take people all the way downtown and would not penetrate the south of Market area where the 38 lines currently provide service.

The alternative encompassing a LRT subway from Laguna to the foot of Post was dropped for similar reasons.

The alternative encompassing a LRT subway from Laguna to Third and Bryant and the alternative encompassing a LRT subway from Laguna to separate portals on third and Fourth were combined to form a single alternative encompassing a subway from Laguna to Howard and Beale with provision for extension southward toward the Bayshore Corridor. The new number of this alternative is Alternative 2B; it is further described in Section II H, below.

The alternative featuring mixed flow electric bus travel west of Laguna and the alternative featuring mixed flow dual mode bus travel west of Laguna were combined to form a single alternative featuring dual mode limited stop service and electric trolley bus local service west of Laguna. The new number of this alternative is Alternative 3A; it is further described in Section II H, below.

The alternatives featuring dual mode bus median travel between 39th Avenue and Laguna were dropped, because of the perceived advantages of electric bus operation.

The alternative featuring electric bus mixed flow travel between 39th Avenue and Taylor was dropped because the value of the relatively short subway combined with mixed flow travel west of Taylor was deemed to be insufficient to justify the capital cost of subway construction.

The alternative featuring semi-exclusive surface bus lanes on Geary and O'Farrell and the alternative featuring two way surface travel on Geary will be combined into a single alternative featuring a mall on the section of Geary between Mason and Kearny and mixed flow or semi-exclusive bus travel west of Mason as appropriate. The new number of this alternative is Alternative 4; it is preliminarily described in Section II H, below.

H. The Seven Candidate Alternatives

Following is a description of the seven (7) alternatives selected by the San Francisco Public Utilities Commission, on May 10, 1994, for further evaluation:

1) Transportation Systems Management (TSM): Alternative 1 is defined as follows:

Vehicles

Replace articulated diesel buses with low floor articulated diesel buses as they become available to reduce access and egress dwell times, to better serve disabled persons and to reduce the delays and schedule fluctuations associated with wheelchair boardings and alightings.

No changes in propulsion system are contemplated under Alternative 1.

Fare Collection

No changes in current fare collection procedures are contemplated under Alternative 1.

Transit Preferential Treatment

Provide transit preemption at selected signalized intersections that are not part of the two-way signal progression system. The City's traffic signal system affecting Geary between Arguello and 33rd Avenue alternates two intersections without signals (but with left-turn pockets), with two intersections with traffic signals (but without left-turn pockets). As originally designed, this system helped both traffic flow and MUNI operations. However, several of the signals added more recently are impeding traffic which in turn interferes with bus operations. Bus pre-emption of at least these signals is warranted.

Convert these signals to demand-activated units, such that signals would remain green for Geary, unless activated to handle cross traffic or serve pedestrian needs, provided a Geary transit vehicle were not approaching. The candidates for conversion are located at:

- Geary and 8th Avenue,
- Geary and 18th Avenue,
- Geary and 27th Avenue, and
- Geary and 30th Avenue.

Similarly convert other traffic signals that were part of the original system but which unnecessarily favor light side street volumes located at:

- Geary and Collins,
- Geary and Stanyan,

- Geary and 36th Avenue, and
- Point Lobos Avenue and 48th Avenue

2A) Geary/Market Light Rail Subway/Surface Line: Alternative 2A is defined as follows:

Vehicles

Replace articulated diesel buses with low floor articulated light rail vehicles (LRVs). LRVs would be of the "low floor" type (floor level 12 to 14 inches above top of rail) to reduce access and egress dwell times, to better serve disabled persons and to reduce the delays and schedule fluctuations associated with wheelchair boardings and alightings.

Fare Collection

Activate a "proof-of-payment" fare system to eliminate the need for patrons to pass by the MUNI operator or other agent or a fare gate. Fares would be checked by a roving inspector. (Under a proof-of-payment system, fares would be randomly checked by roving inspectors. If someone were caught on board without a ticket, transfer, fast pass or other valid evidence of payment, he or she would be fined).

A proof-of-payment system has been used successfully in connection with fixed guideway service elsewhere in the country. Such a system would result in faster boarding, avoidance of fare disputes between operators and patrons, elimination of subway fare collection facilities and elimination of the need for an operator to staff the trailing vehicle of a two-car train.

The Route

Surface operation from the westerly terminal near Point Lobos Avenue and Merrie Way along Point Lobos and Geary to a portal just west of Laguna; then in subway under Geary and O'Farrell; then on surface to the easterly terminal at Transbay Terminal or foot of Market.

West of 39th Avenue, the surface operation is in mixed flow traffic. The western terminal of the line may be located on a proposed site located within Golden Gate National Recreational Area. (See discussion in Section II L.)

Between 39th Avenue and the Laguna Street portal, the surface operation is in median. Four alternative ways of running in median are under consideration (see Appendix B). Low station platforms (either 10 or 14 inches high) are located approximately four blocks apart depending on which median alternative is selected. Stations will have shelters and lighting. Left turn lanes will be retained or relocated where

possible. Cars will turn left on their own traffic signal phase from outside the trackway. No sidewalk narrowing will occur. Existing traffic lane and parking configurations will be changed only to the extent necessary to make room for the rail operation. Areas not devoted to parking, traffic lanes, crosswalks, or platforms will be landscaped.

The trackway passes through the Fillmore and Presidio/Masonic areas on viaduct. The viaduct through the Presidio/Masonic area proceeds from Divisadero to the surface of Presidio Avenue and from the surface of Masonic to Collins. (As an alternative, the entire section between Laguna and Presidio Avenue, as well as the section between Masonic and Collins, could be on viaduct).

The inbound (eastbound) Geary subway is routed from the portal just west of Laguna under Geary, Taylor and O'Farrell to a portal on O'Farrell just east of Powell, after which the inbound line rises to the surface and proceeds via the surface of O'Farrell, Market and First Streets to the Transbay Terminal (TBT), or via the surface of O'Farrell and Market to the foot of Market. An inbound subway station is located under O'Farrell between Mason and Powell.

The outbound line proceeds from the foot of Market or the TBT via the surface of Market (or Fremont and Market), and Geary where it descends into a subway at a portal located just east of Grant, and then proceeds under Geary to the portal at Laguna.

An outbound subway station is located under Geary, also between Powell and Stockton. Other subway stations are located at Van Ness and Leavenworth.

Auxiliary Bus Route Changes

The 38-Geary Local and the 38L-Geary Limited would be eliminated under this alternative except for the 38-Geary Owl service. The Owl service would continue as it currently exists.

The current 2-Clement bus would be altered. The route would run from its current downtown terminal at the ferries along Geary/O'Farrell to Webster Street, where it would continue the present 2 route on Sutter Street and Clement. The 2 route would be rerouted on the western end to terminate at Ocean Beach. This line would be designed to replace the 38-Ocean beach service and to provide local bus service in the subway segment operating through the Tenderloin District.

The 2 line would provide seven-day service at ten-minute peak, twenty-minute base, fifteen minute weekend day, and thirty-minute weekend evening headways. Service on this line would be extended later into the evening, providing service until midnight when Owl service begins.

A shuttle route would be implemented to serve Fort Miley from the 40th Avenue Light Rail stop. Service would be comparable to the current frequencies and use the same street as the existing 38-Geary from 40th Avenue to Fort Miley. The Fort Miley shuttle would provide weekday service at eight-minute peak, ten-minute base, and twenty-minute evening headways for evening service.

2B) Geary/Third/Howard Light Rail Subway/Surface Line: Alternative 2B is defined as follows:

Vehicles

Same as 2A.

Fare Collection

Same as 2A.

The Route

Same as Alternative 2A, except that a two-way Geary-only subway turns south on Kearny and extends underground across Market (but above the existing Market Street subway) to a branch a Third and Howard. The Howard Street branch proceeds under Howard to Beale. The Third Street branch (not included in the Geary Corridor Project) proceeds southward for a connection to the Bayshore Corridor Line.

Subway stations are located at Van Ness, Leavenworth, Union Square, Third just south of Market, Howard at Second, and Howard at Beale. (A Bayshore Corridor station is located under Third between Folsom and Harrison).

Provides for future northerly extension via Kearny.

Auxiliary Bus Route Changes

Same as 2A.

3A) Electric Trolley Bus/Dual Mode Bus Subway/Surface Line: Alternative 3A is defined as follows:

Vehicles

Replace articulated diesel buses with articulated electric buses and articulated dual mode buses. All Geary Corridor buses would be of the "low floor" type (floor level 12 to 14 inches above the pavement) to reduce access and egress dwell times, better serve disabled persons and reduce the delays and schedule fluctuations associated with wheelchair boardings and alightings.

Under this alternative, the local service along Geary and all service in the subway would be electrified to maximize the use of electric trolley buses. Limited stop service would utilize dual mode diesel/electric vehicles capable of operating under diesel power along the surface of Geary and from electric trolley wires in the subway.

Fare Collection

No changes in current fare collection procedures are contemplated under Alternative 3A.

The Route

The Geary bus line, including the Fort Miley, Point Lobos and extended Ocean Beach branch lines, is electrified. Limited stop bus service is provided using mixed flow dual mode buses (buses that use electric power in subways and diesel or other fossil fuel propulsion on the surface). Local trolley bus service is provided during the day between Ocean Beach/Ft. Miley and downtown.

Buses from the three branch lines proceed in mixed flow traffic along Geary to a portal located just west of Laguna.

Subway routing is the same as for Alternative 2B except that eastbound Howard Street buses emerge from the subway at a portal on Howard east of Fremont Street and westbound Howard Street buses enter the subway at a portal on Howard between Second and Third Streets.

Subway stations are located at Van Ness, Leavenworth, Union Square, Third just south of Market and, for eastbound buses only, on Howard at Second. (A Bayshore Corridor station is located under Third between Folsom and Harrison).

Dual mode buses from other lines may use the bus subway.

Provides for future northerly extension via Kearny, and southerly extension via Third for connection to Bayshore Corridor Line. Can accommodate future conversion to LRT or LRT/busway operation.

Auxiliary Bus Route Changes

The 38-Geary Local and the 38L-Geary Limited would be eliminated under this alternative except for the 38-Geary Owl service. The Owl service would continue as it currently exists.

The current 2-Clement bus would be altered. The route would run from its current downtown terminal at the ferries along Geary/O'Farrell to Webster Street, where it would continue the present 2 route on Sutter Street and Clement to its existing western terminus.

The 2 line would provide seven-day service at ten-minute peak, twenty-minute base, fifteen minute weekend day, and twenty-minute weekend evening headways. Service on this line would be extended later into the evening, providing service until midnight when Owl service begins. Between 7:00 p.m. and the start of Owl service, the 2 line would run between the Transbay terminal and Fillmore/Sutter.

3B) Electric Trolley Bus Subway/Surface Line (Long Tunnel): Alternative 3B is defined as follows:

Vehicles

Replace articulated diesel buses with articulated electric trolley buses. All Geary Corridor buses would be of the "low floor" type (floor level 12 to 14 inches above the pavement) to reduce access and egress dwell times, better serve disabled persons and reduce the delays and schedule fluctuations associated with wheelchair boardings and alightings. Under this alternative, all service along Geary and in the subway would be electrified.

Fare Collection

Same as 2A.

The Route

Subway location and configuration are identical to Alternative 3A.

West of 39th Avenue, the operation is in mixed flow traffic.

Between 39th Avenue and the Laguna Street portal, the operation is in median. Median conditions are the same as for the LRT alternatives.

Median will be laid out and designed to facilitate possible future conversion to LRT.

Buses travel through the Fillmore and Presidio/Masonic areas on viaduct similar to that described for the LRT alternatives.

(To avoid the early construction of expensive viaducts and thereby conserve initial capital outlays, it would be possible to initially route buses on mixed flow traffic lanes through these areas).

Auxiliary Bus Route Changes

Same as 2A.

3C) Electric Trolley Bus Subway/Surface Line (Short Tunnel): Alternative 3C is defined as follows:

Vehicles

Same as 3B.

Fare Collection

Same as 2A.

The Route

Routing and configuration are the same as Alternative 3B except that instead of entering subway at Laguna:

a) the eastbound line remains on the surface and proceeds via median to Gough and then via a mixed flow or semi-exclusive bus lane along Starr King and O'Farrell to a portal just west of Taylor; then in subway via Taylor to Geary, and

b) the westbound subway ends at a portal on Geary just west of Taylor, after which the westbound line ascends to the surface and proceeds in mixed flow or semi-exclusive bus lanes along the surface of Geary to Gough and thereafter in median.

Auxiliary Bus Route Changes

The 38-Geary Local and the 38L-Geary Limited would be eliminated under this alternative except for the 38-Geary Owl service. The Owl service would continue as it currently exists.

The current 2-Clement bus would extend further west than its present terminus and be rerouted at Ocean Beach. This line would be designed to replace the 38-Ocean beach service.

The 2 line would provide seven-day service at ten-minute peak, twenty-minute base, fifteen minute weekend day, and thirty-minute weekend evening headways. Service on this line would be extended later into the evening, providing service until midnight when Owl service begins.

A shuttle route would be implemented to serve Fort Miley from the 40th Avenue Light Rail stop. Service would be comparable to the current frequencies and use the same street as the existing 38-Geary from 40th Avenue to Fort Miley. The Fort Miley shuttle would provide weekday service at eight-minute peak, ten-minute base, and twenty-minute evening headways for evening service.

4) Surface Light Rail Line: Alternative 4 is defined as follows:

Vehicles

Same as 2A.

Fare Collection

Same as 2A.

The Route

West of 39th Avenue, the operation is in mixed flow traffic.

Between 39th Avenue and Gough, LRVs travel in median very similar to the one described for Alternative 2A.

Between Gough and Mason, LRVs travel in mixed flow or semi-exclusive lanes or exclusive transit lanes. Additional information about service between Gough and Market is found in Appendix C.

Auxiliary Bus Route Changes

Same as 3C.

For diagrams of the seven (7) selected alternatives, see Figures 3A -3G, which follow. For a tabulation of subway stations, see Figure 4.

Alternative 1 - TSM

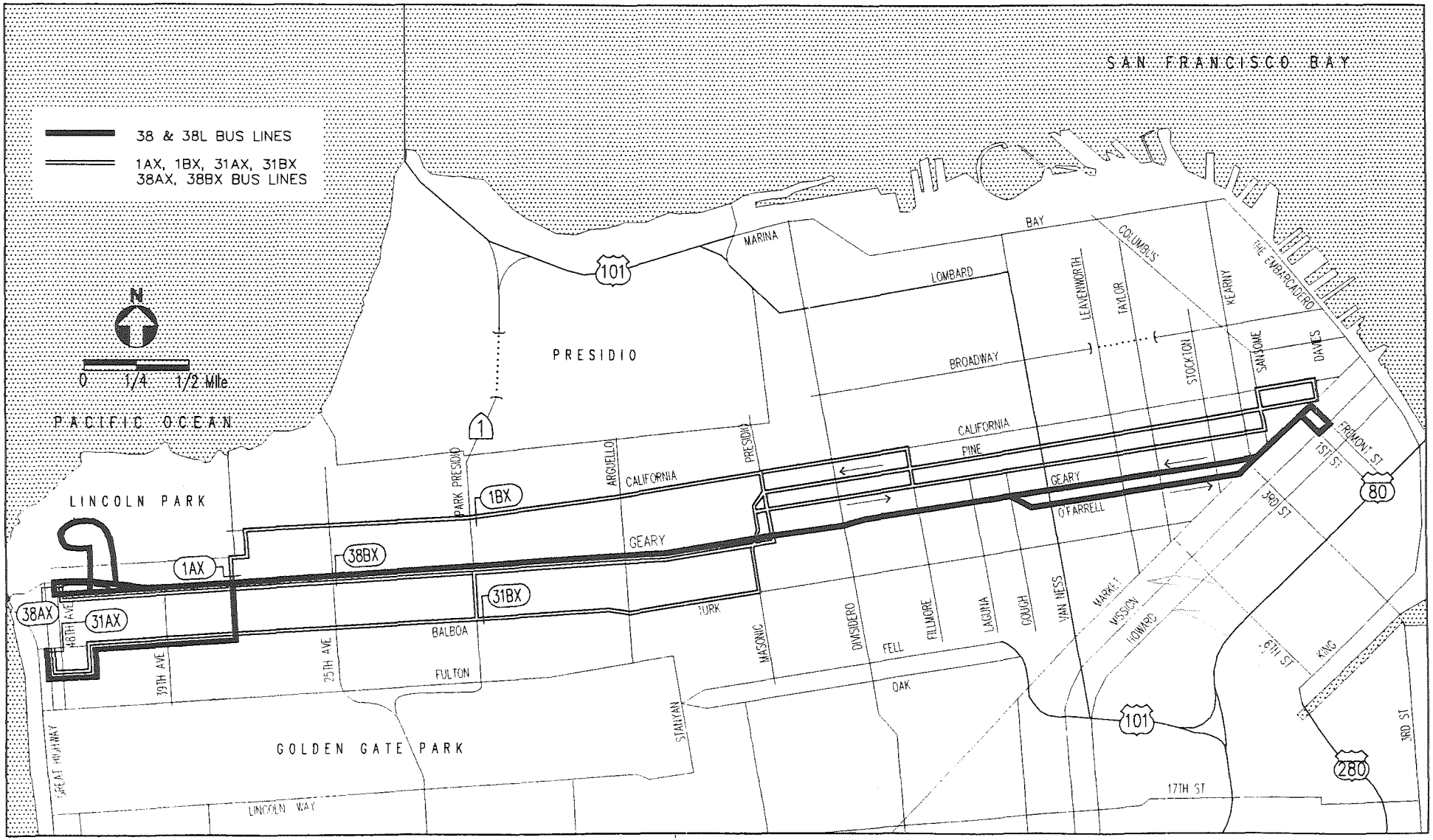


Figure 3A

MUNI GEARY TRANSIT STUDY

Alternative 2A - Partial Subway Light Rail

(Subway from Laguna to Union Square)

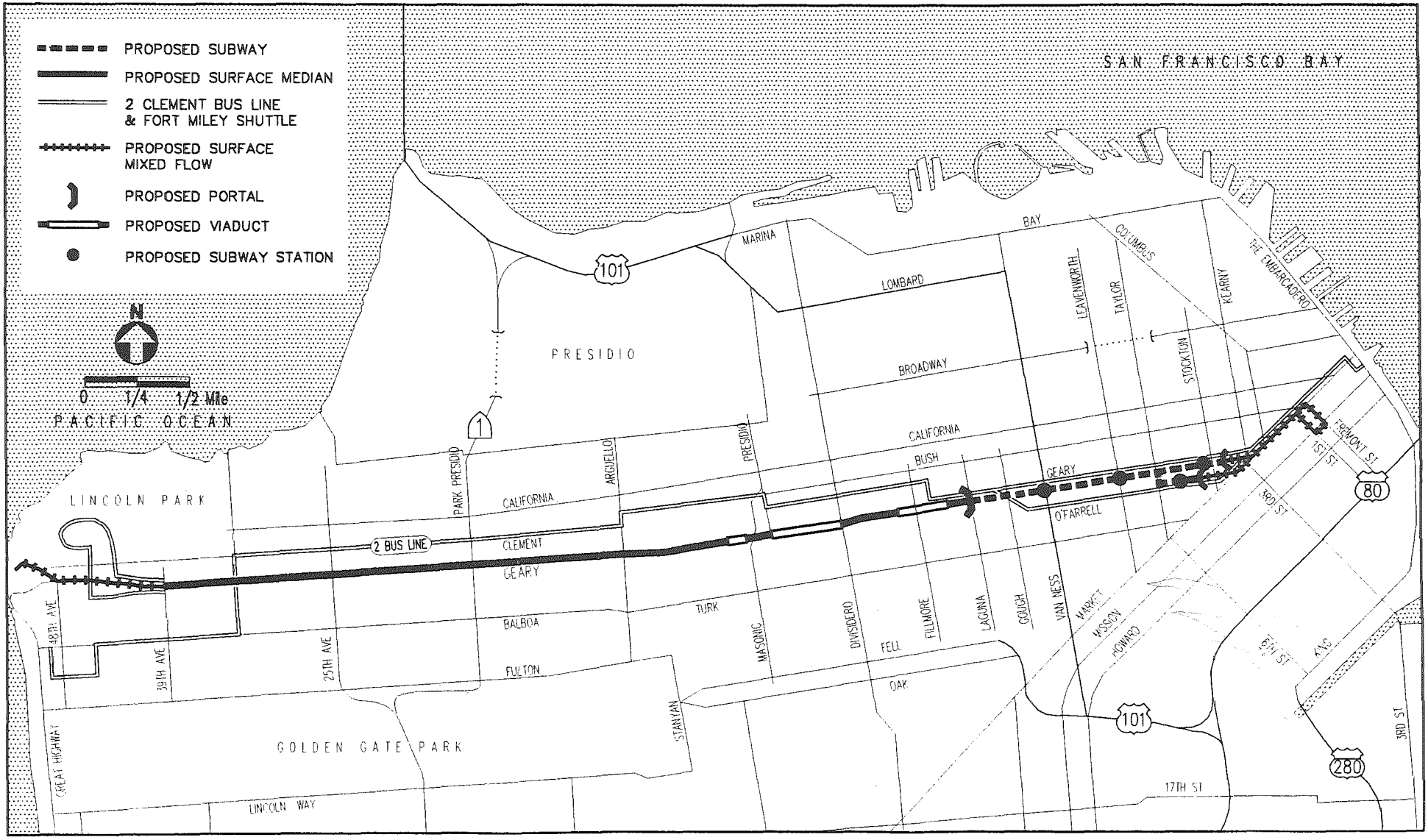


Figure 3B

MUNI GEARY TRANSIT STUDY

DATE 11/29/

Alternative 2B - Partial Subway Light Rail
(Subway from Laguna to South of Market)

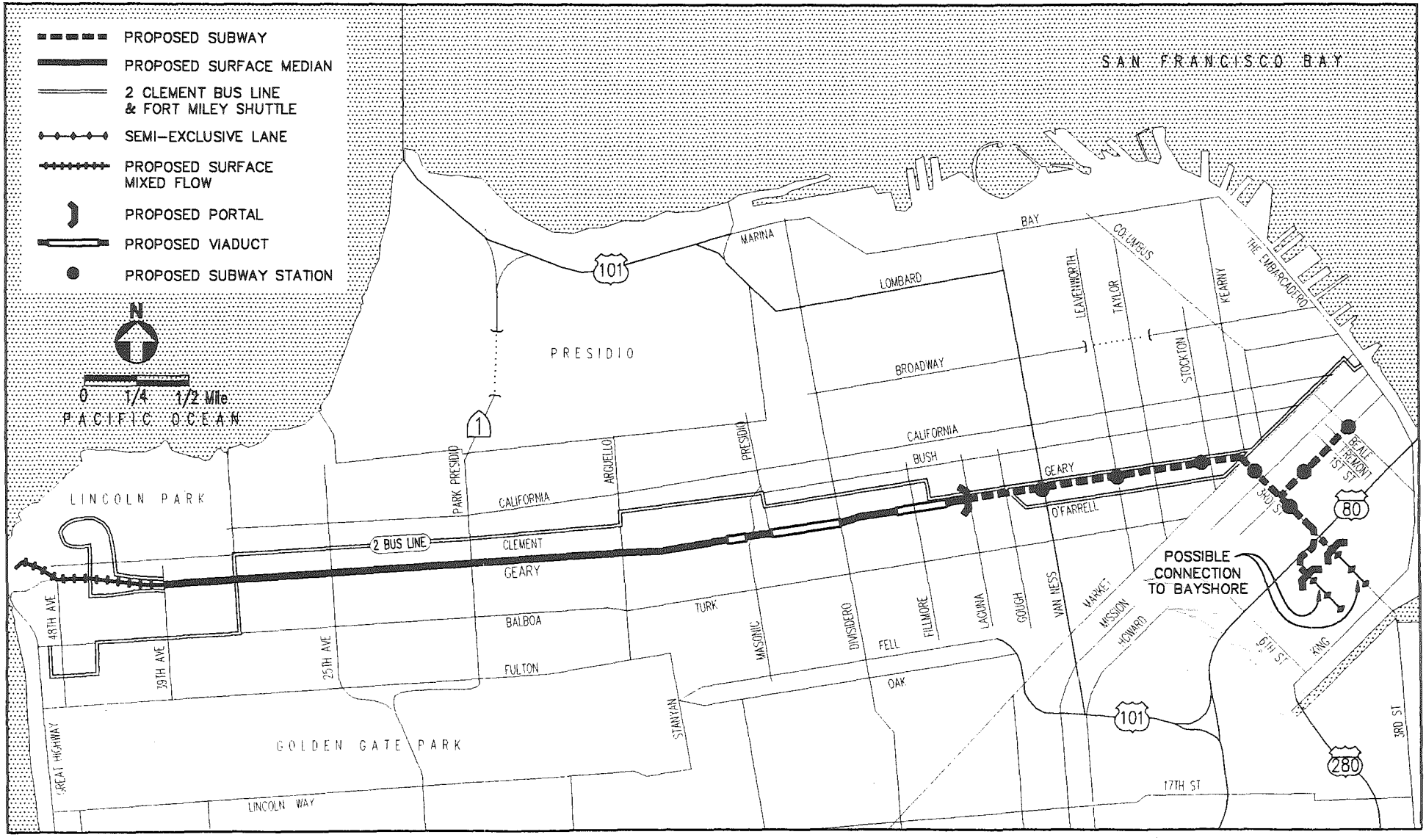


Figure 3C

MUNI GEARY TRANSIT STUDY

DATE 11/22/

Alternative 3A - Partial Subway Trolley Bus

With Limited Dual Mode (Mixed flow west of Laguna)

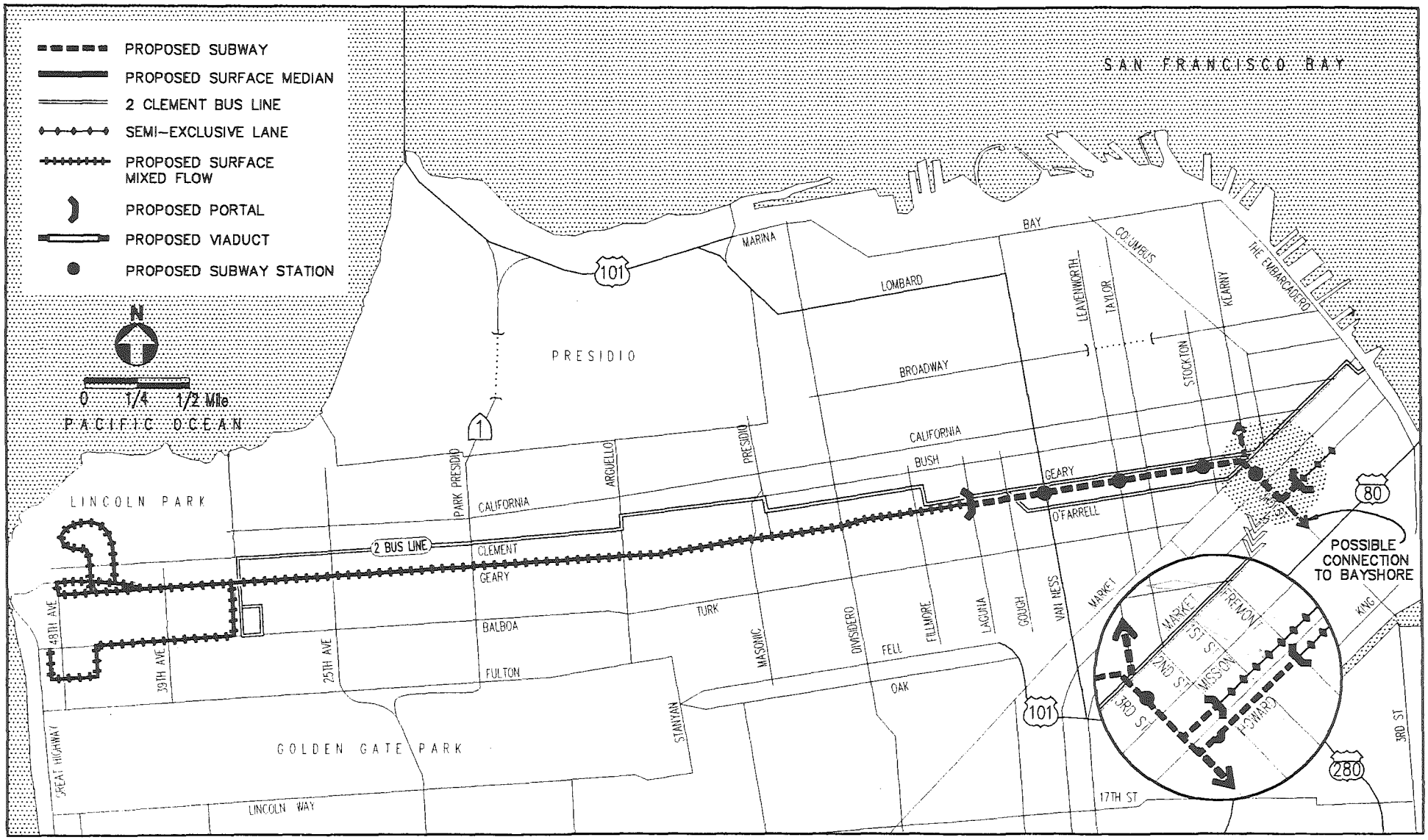


Figure 3D

MUNI GEARY TRANSIT STUDY

Alternative 3B - Electric Trolley Bus

(Median surface operation west of Laguna)

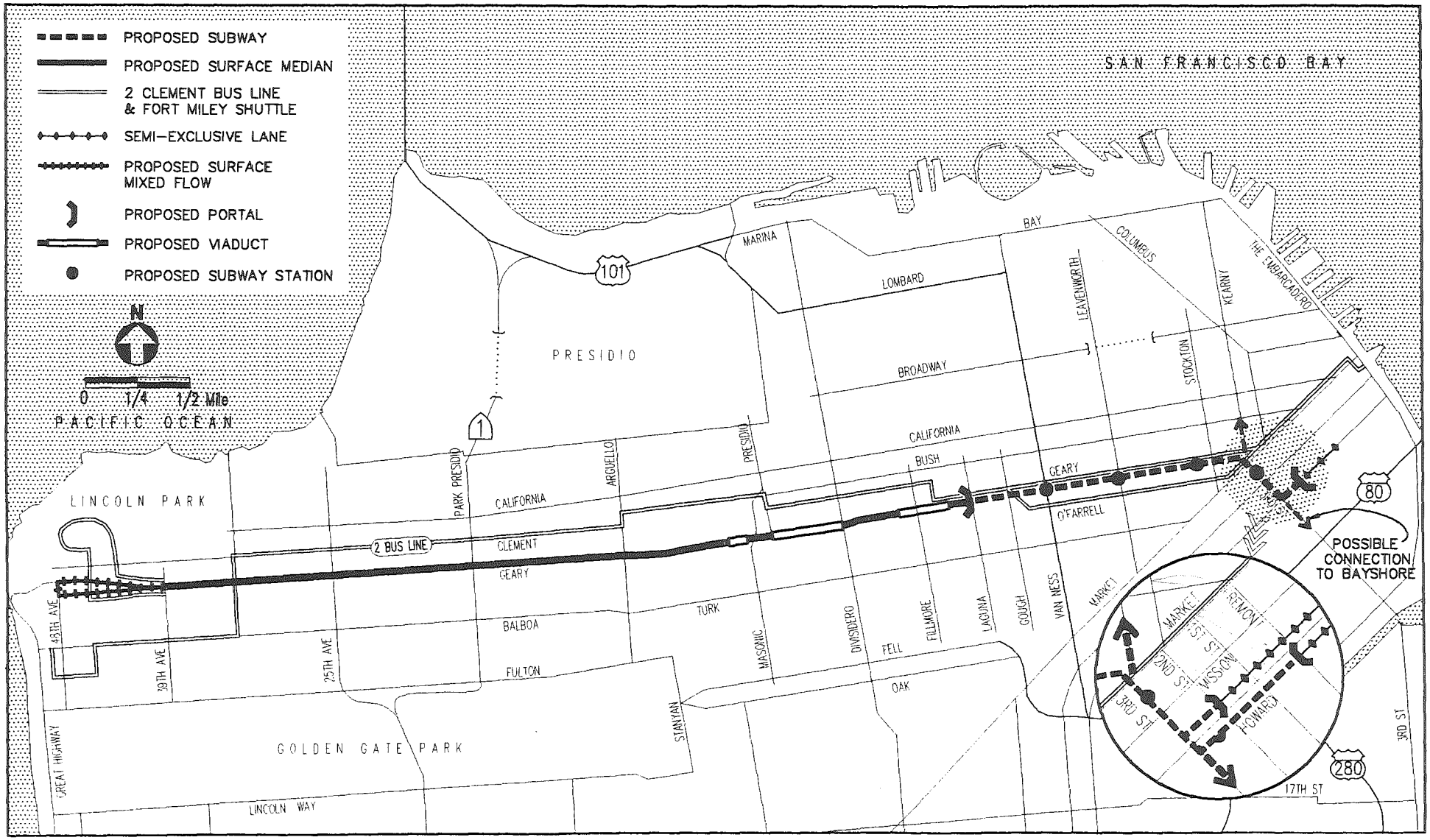


Figure 3E

MUNI GEARY TRANSIT STUDY

Alternative 3C - Electric Trolley Bus

(Median surface operation west of Taylor)

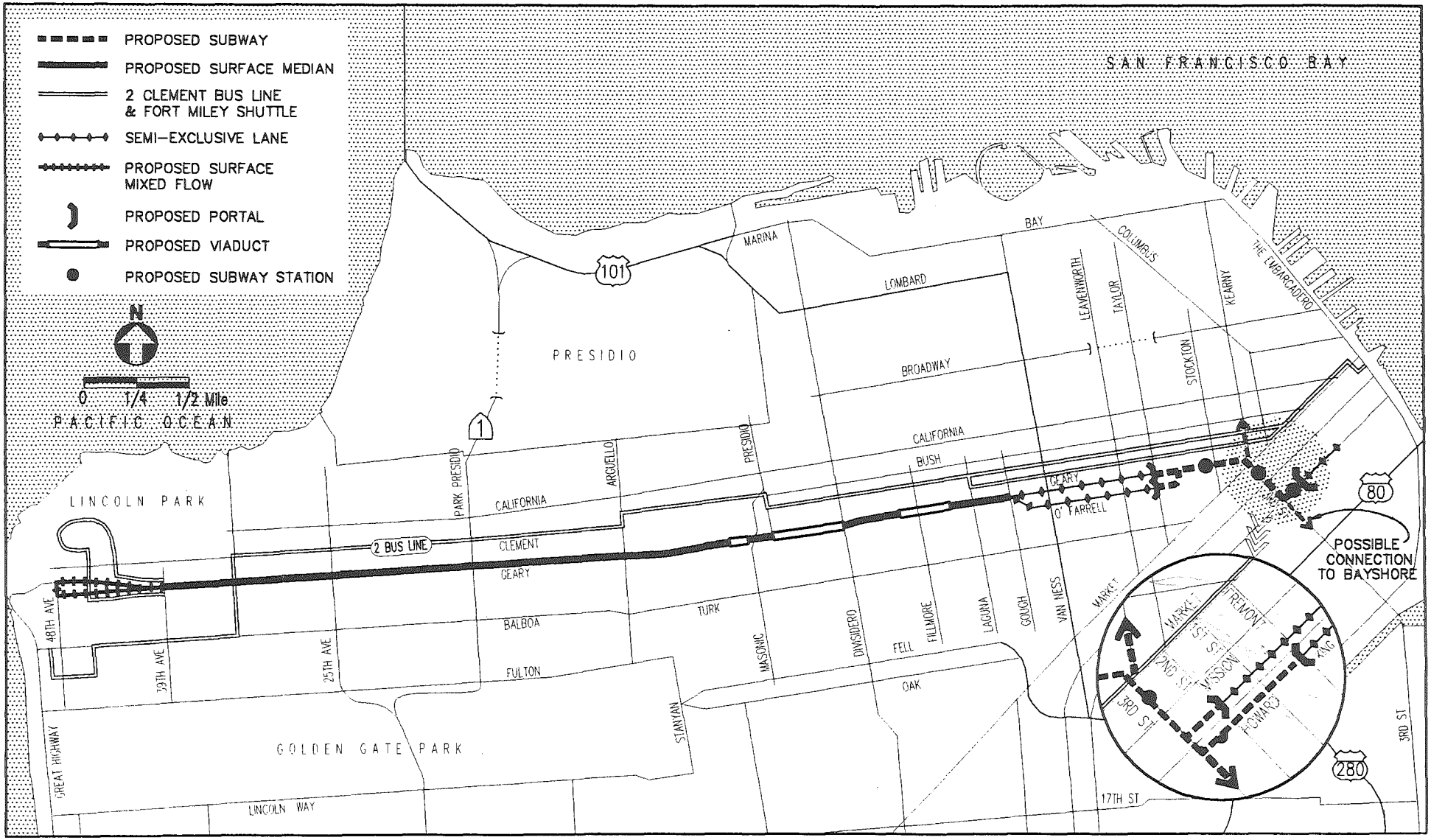


Figure 3F

MUNI GEARY TRANSIT STUDY

DATE 11/22/

Alternative 4 - All Surface Light Rail

(Transit Mall between Mason & Kearny)

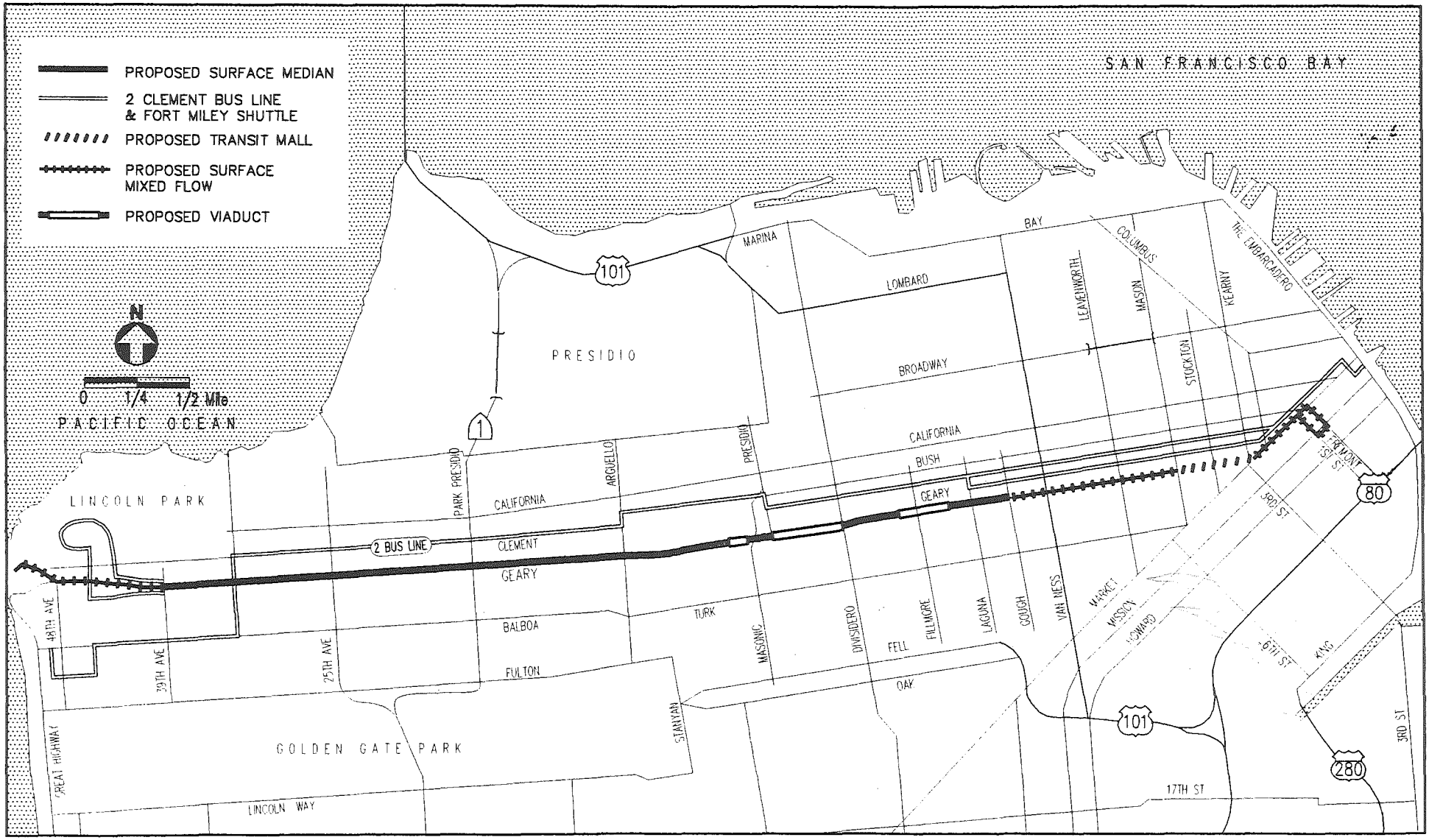


Figure 3G

MUNI GEARY TRANSIT STUDY

SUBWAY STATIONS

	Van Ness	Leavenworth	Geary Union Square (OB only)	O'Farrell Union Square (IB only)	Geary Union Square (IB and OB)	3rd South of Market (w/ped. connection to Montgomery St.)	2nd & Howard	2nd & Howard (IB only)	Beale & Howard
TSM	-	-	-	-	-	-	-	-	-
2A	●	●	●	●					
2B	●	●			●	●	●		●
3A	●	●			●	●		●	
3B	●	●			●	●		●	
3C	-	-			●	●		●	
4	-	-	-	-	-	-	-		-

Figure 4

PARSONS BRINCKERHOFF

I. The BART Analysis

At the request of the Bay Area Rapid Transit District Board of Directors, the Geary Corridor System Planning Study was modified in the fall of 1994 to provide for an assessment of what effect a BART regional line running under Geary between Market and Sixth Avenue would have on four of the Geary Corridor MUNI alternatives. The purpose of the analysis was to explore the potential feasibility of joint planning, construction, and operational opportunities for regional and local transit services in the Geary Corridor. The BART regional alternative would provide service to Marin County through the Geary Corridor from the East Bay and San Francisco Airport.

The BART Alternative as defined by BART is shown in Figure 5. As indicated, the portion of the proposed BART regional alternative lying within the Geary Corridor would be entirely in subway. BART-only subway stations would be located at Fillmore, Presidio and Sixth Avenue, and a BART/MUNI joint use subway station located at Van Ness. Cost estimates were developed assuming center loading platforms at all stations. The capital costs for the Geary Corridor portion of the BART line are shown in Table 1A. Patronage estimates are given in Table 1B and indicate that future ridership for MUNI Geary Transit Study alternatives is still high enough, with the presence of BART in the Corridor, to justify their construction.

The conclusions reached as a result of this assessment are summarized in Section IV. Additional information about the BART analysis is presented in a separate report entitled "The BART Regional Alternative: its Effect on MUNI". The report concluded that linking Northbay counties to San Mateo County and the Eastbay counties would create significant travel opportunities for public transit users and is therefore deserving of further consideration.

J. Vehicle Storage and Maintenance

Whenever a new fixed guideway service is contemplated, it is necessary to consider how the additional required vehicles would be stored and maintained. If one of the bus alternatives were implemented it is anticipated that the proposed new MUNI facility at Islais Creek would accommodate the approximately 45 additional buses required. If a light rail alternative were selected, the Metro East rail storage and maintenance facility, as it is currently being planned by MUNI, would be large enough to accommodate the 38 to 46 light rail vehicles (including spares) that would be dedicated to Geary Corridor rail operations.

BART Regional Alternative

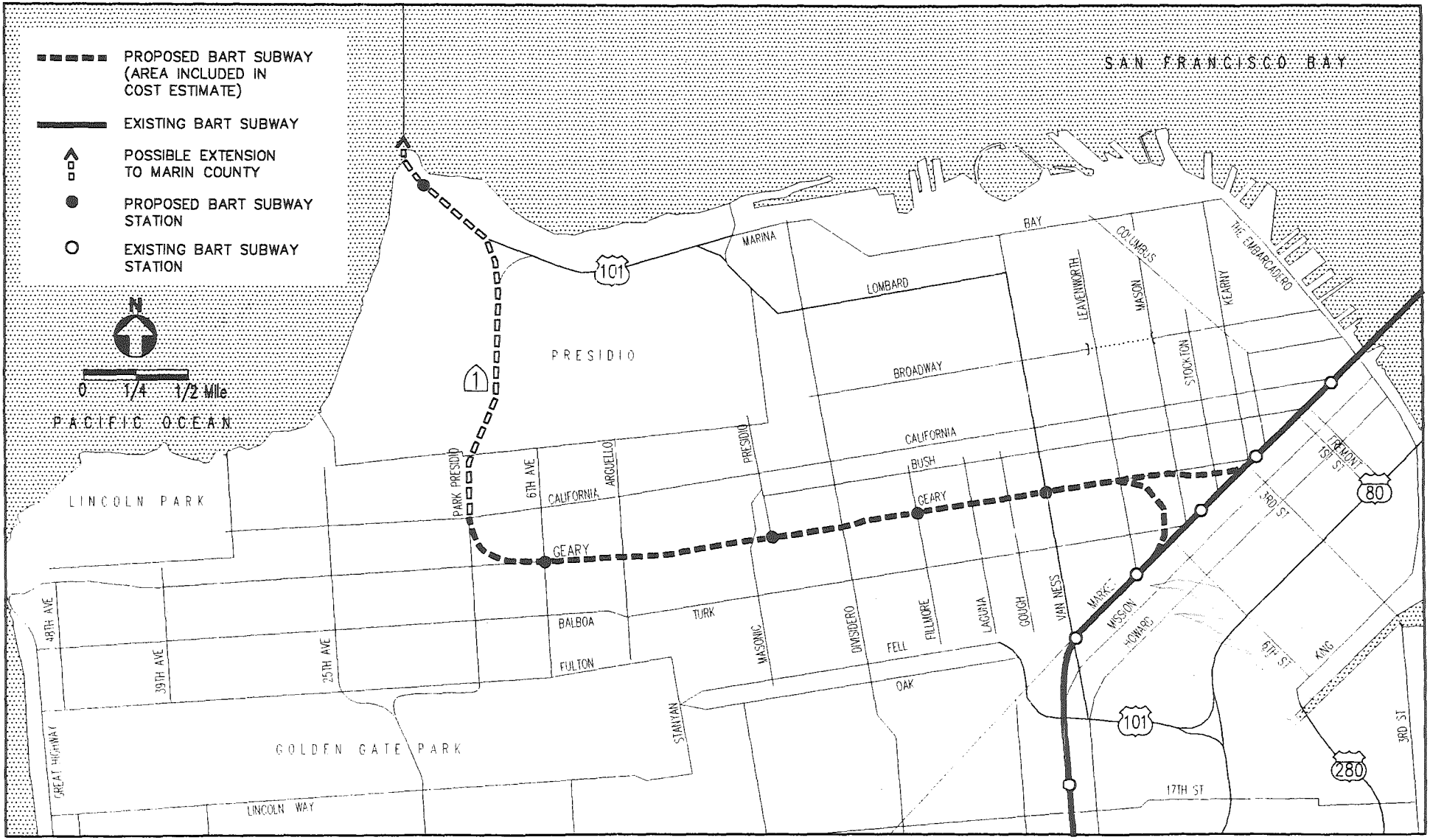


Figure 5

MUNI GEARY TRANSIT STUDY

BART with MUNI Alternatives 1, 2B, 3C, & 4

Capital Cost Estimate Summary
(costs in million dollars)

Alternative	BART Cost	MUNI Cost without BART	MUNI Cost with BART	Cost effect on MUNI	Remarks
1	1352.4	33.0	33.0	0	BART Cost is the same if there are no new MUNI facilities
2B	1355.3	899.8	910.8	11	
3C	1352.4	484.8	491.3	6.5	
4	1352.4	333.9	340.3	6.4	

*All costs are in 1994 dollars.

Table 1A

BART Alternative Daily Boardings (2010)

		(A)	(B)	(C)	(A+B+C)	
MUNI Alternative	MUNI Boardings on Geary Blvd. Lines (Without BART)	BART (A) Boardings External to Geary Corridor	New Transit (2) Boardings on BART Within the Geary Corridor	Diversion (3) from MUNI to BART Within the Geary Corridor	Total (4) BART Boardings	MUNI (5) Boardings on Geary Blvd. Lines (With BART)
TSM	62,700	2,600	500	16,000	19,100	48,100
2B	79,300	2,600	200	15,200	18,000	64,100
3C	73,900	2,600	300	15,100	18,000	58,800
4	69,900	2,600	400	15,500	18,000	54,900

(1) Boardings for trips between Marin County and San Mateo County or the East Bay, and for trips between external counties and San Francisco districts not in the Geary Corridor (such as North Beach or the Mission District).
(2) New transit riders diverted from the automobile.
(3) Diversion from MUNI services operating on Geary Blvd., except for the TSM Alternative where an additional 1,400 boardings would be diverted from MUNI routes on parallel streets such as Balboa and California.
(4) Does not include boardings generated by increased BART frequencies through the Transbay Tube or in the East Bay.
(5) Original MUNI boardings estimated for Geary Corridor alternatives without BART, less estimated diversions to BART.

Source: Parsons Brinckerhoff, February 1995

Table 1B

K. Connections to Other Transit Services

Following is a description of how the seven Geary Corridor alternatives described above would connect to other transit services.

- Connections to MUNI Bus Lines: None of the alternatives would require significant changes in connections to the MUNI feeder buses currently crossing the existing 38 line.

- Connections to Other Rail Services and to the Transbay Terminal:

Alternatives 2A and 4: Under Alternatives 2A or 4, light rail vehicles would utilize the existing tracks on the surface of Market Street east of the points where Geary and O'Farrell join Market. Connections to the MUNI Metro and BART Market Street subway systems would therefore be direct and immediate with either of these alternatives.

Under the ongoing Caltrain Downtown Terminal Relocation Project, two ways of extending the Caltrain commuter rail service into downtown San Francisco are under consideration. One alternative would extend Caltrain under Beale Street to Market and incorporate mezzanine-level moving sidewalks to facilitate pedestrian movement between the Transbay Terminal and Market. The other would similarly improve pedestrian connections between the Transbay Terminal and Market by use of either elevated or subsurface moving sidewalks. If the Transbay Terminal and the Caltrain station were "brought closer" to Market in this manner, connections to and from a Geary light rail line running on Market would be direct and immediate. Under either of these scenarios, it would be possible to extend the Geary light rail service to the foot of Market instead of detouring it to the Transbay Terminal as is currently anticipated. Extending the Geary line to the foot of Market would improve connections to the Embarcadero and to the Ferryboat Terminal.

Geary Corridor connections to the proposed future Bayshore Corridor light rail line would depend upon whether the Bayshore line is extended along the Embarcadero and into the MUNI Metro level of the Market Street subway or via a subway under Third Street between Bryant and Market for a possible connection with a future Chinatown/North Beach Corridor subway. If Bayshore Corridor vehicles passed under Market at Third, connections to Geary Alternatives 2A and 4 would be via a Bayshore subway station at Third and Market.

The TSM Alternative: The TSM Alternative, since it would also utilize the surface of Market Street, would afford the same regional connections as Alternatives 2A and 4. A bus line on Market could be extended to the foot of Market (and beyond) if a Caltrain/Transbay Terminal pedestrian connection to Market was provided as described above.

Alternative 2B: Under Alternative 2B, light rail vehicles would be routed from the Geary subway southward under Market and Third to Howard where they

would turn east and travel under Howard to a subway terminal station at Howard and Beale.

Connections to the Market Street subway lines would be via a Geary Corridor subway station located at Third and Market, with moving sidewalks at mezzanine level connecting the Third Street Station with the existing Montgomery Street Station. See Figure 6.

The Bayshore line and the Geary line would be sharing about 110 feet of track in the Third Street subway between Geary and Howard; connections between these two lines would be via the subway station proposed for construction at Third and Market.

Connections to Caltrain and the Transbay Terminal would be via the Howard and Beale Street Station.

Alternatives 3A, 3B and 3C: The routing of Alternatives 3A, 3B and 3C is similar to the routing of Alternative 2B. Under 3A, 3B and 3C, electric trolley buses would travel from the Geary subway southward under Market and Third to Howard where they would connect through separate eastbound and westbound portals to the surface of Howard and then along the surface of Howard to Beale or to a terminal to the east of Beale.

Connections would be similar to those described under Alternative 2B.

L. Technical Issues

During the course of the study, a number of technical issues were identified, evaluated and discussed in the public meetings. Following is a summary of several which evoked discussion during the public participation program:

1. The Outer Geary Median Operation

For Geary Corridor Alternatives 2A, 2B, 3B, 3C and 4, a transit-only median has been provided along the section of Geary extending from 39th Avenue to Laguna. Drawings and diagrams describing this median can be seen in Appendix B. As indicated in the drawings, the median occupies the center of the street and varies in width from 24 to 36 feet wide depending upon various factors including street width, transit station location and left turn requirements.

By separating transit vehicles from other traffic, eliminating some left turn lanes and pre-empting certain traffic signals the proposed median operation would facilitate higher transit speeds and greatly improve transit reliability. By providing wider center islands between opposing lanes of traffic, and by reducing the number of traffic lanes in some sections, the presence of the median would make the experience of trying to get across Geary easier and much less harrowing for pedestrians. The wider median, coupled with attractive station lighting, "bulbed" curbs (wider sidewalks) at some intersections, and landscaping would combine to help transform the street into a more attractive and more "shopper-friendly" thoroughfare than it is today.

At Fillmore and at the Presidio Avenue/Masonic area the transit median would be placed on a viaduct as (opposed to descending into the automobile underpasses). For this reason there would be at-grade station stops at Fillmore and in front of MUNI headquarters just west of Presidio Avenue.

As indicated above, street conditions along the median would vary. In the section between 39th and 28th Avenue there is already parallel parking which would remain. In this section the existing median would be widened as necessary to accommodate the two-way transit operation, leaving two traffic lanes in each direction plus parking.

In the section between 28th and 12th Avenues, all diagonal parking would be converted to parallel parking. Since the median transit operation (whether bus or light rail) would presumably eliminate the need for curbside bus stops, the space now reserved for buses could become available for automobile parking. With these changes it is estimated that no parking spaces would be lost. Without these changes, one space would be lost every two blocks. If necessary, it might be possible to designate additional off-street parking, or parking on certain side streets, to make up for the relatively small deficit caused by the Geary transit median.

In the sections where there are currently four traffic lanes in each direction, plus parking and a landscaped median, (generally between Scott and Gough), the median and most of the existing landscaping would remain. One traffic lane on each side of the median would be converted to exclusive transit operation, leaving three traffic lanes in each direction plus parking.

2. The Downtown Surface Rail Operation

Under Geary Corridor Alternative 4, it is assumed that Geary transit operations would remain entirely on the surface. To provide for the relatively efficient travel of light rail vehicles along the relatively narrow and congested section of Geary east of Gough, it would be necessary to make a number of significant changes in street operations.

A number of alternatives were considered, including one that keeps the current east-on-O'Farrell, west-on-Geary configuration, and another that features two-way transit operations on Geary.

Because of the very severe parking and access problems that would result from the creation of semi-exclusive transit lanes on both Geary and O'Farrell, it was concluded that providing a two way rail operation on Geary would be the least disruptive way of facilitating a surface light rail operation, at least in so far as parking and local access to abutting properties is concerned.

Creating a two way rail operation on this section of Geary would, nevertheless, require some very significant street changes including relocating the entrance to the Union Square Garage from Geary to Post, converting Post between Montgomery and Peter Yorke to a one way, westbound street (except for an eastbound lane accessing the Union Square Garage from Powell), converting

Sutter to a two way street and adding "right turn only" diversion points every two blocks along Geary in both directions.

For more information about the surface rail operation and its effects on nearby streets, see Appendix C.

3. Low Floor versus High Floor Transit Vehicles

Transit vehicle technology has advanced to the point where it is now possible to purchase buses or light rail vehicles with floor levels approximating 12 - 14 inches above grade, as opposed to the 34 inch high floors of earlier generations of vehicles.

Low floor vehicles have the important advantage handling wheel chairs more easily while at the same time making it easier, quicker and safer for others to enter and exit the vehicles. Low platforms used for passenger boarding are less visually intrusive than high platforms.

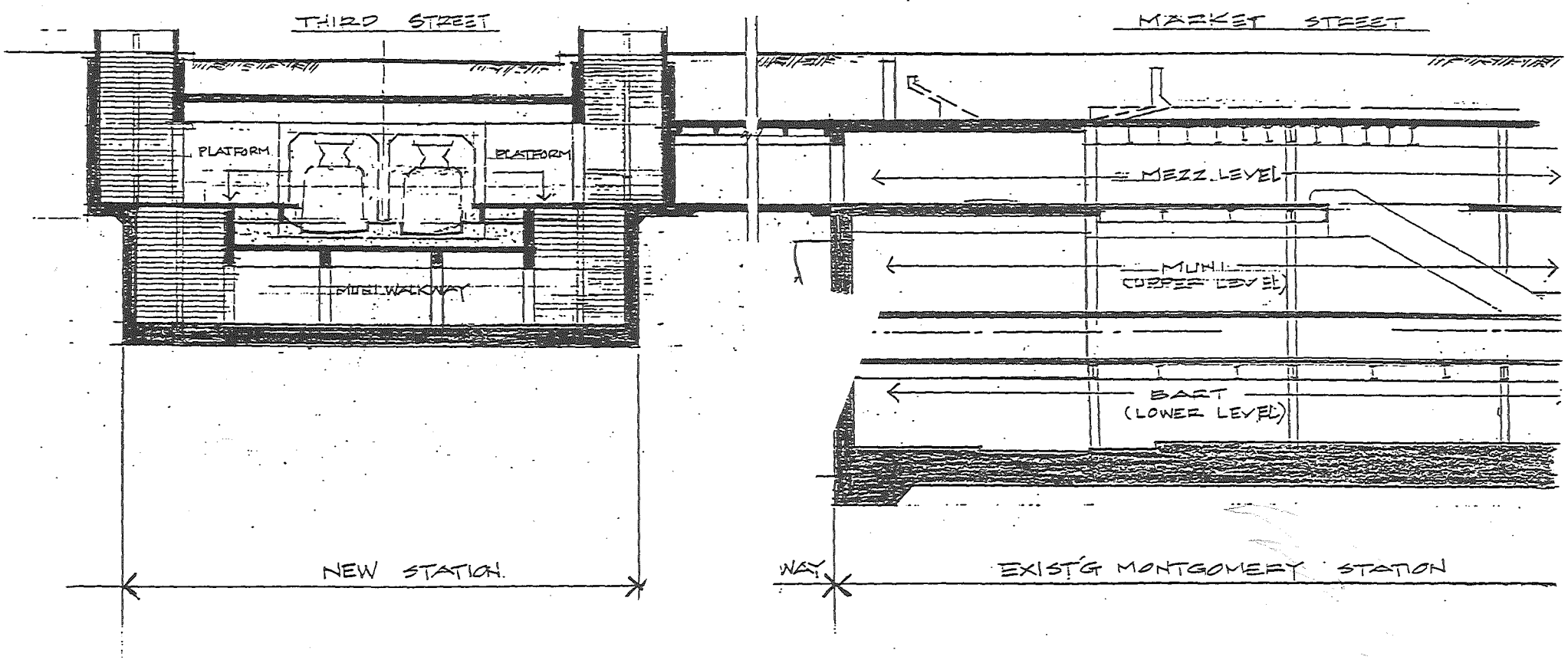
Low floor vehicles were assumed when developing projected patronages and cost estimates of the seven Geary Corridor Alternatives. However, high floor operation is not precluded.

4. Getting Across Market Street

In view of the strong desire of MUNI to find a way of connecting a Geary Corridor surface or subway/surface to south of Market destinations, a number of ways of crossing Market were considered. Surface crossings, while possible at several locations, were not included in any of the selected alternatives. To cross a downtown section of Market Street below grade it would be necessary to cross either above or below the existing Market Street subway.

In the downtown area, a shallow subsurface crossing of Market would be feasible only at Third Street, see Figure 6. East of Third, the presence of the Montgomery and Embarcadero Stations, and the shallow connecting sections makes it impossible to construct a shallow crossing. A deep crossing is possible but was deemed cost prohibitive.

To build a shallow subsurface crossing at Third Street (as was assumed for Geary Corridor Alternatives 2B, 3A, 3B and 3C) it would be necessary to pass below the many existing Market Street utility lines but above the existing subway. Using modern cut and cover construction methods this is feasible and the cost of the undertaking has been included in the cost estimate.



The Third an **HEME 2**
(CROSS)

Figure 6

5. The Western Rail Terminal

Outer Richmond residents near the existing 38-line bus terminal at 48th Ave. and Pt. Lobos expressed concern about the impacts of a rail terminal at that location. MUNI Staff approached Golden Gate National Recreation Area (GGNRA) staff to discuss the feasibility of locating a rail terminal within the Sutro Heights District park lands north of Pt. Lobos. Four possible sites were discussed (see Figure 8):

(a) From the intersection of Pt. Lobos and 48th turn right onto El Camino Del Mar and terminate in the existing parking area for the GGNRA - U.S.S. Francisco Memorial.

(b) Continue on Pt. Lobos through 48th Ave. and turn right onto Merrie Way and terminate on the north end of the existing parking area.

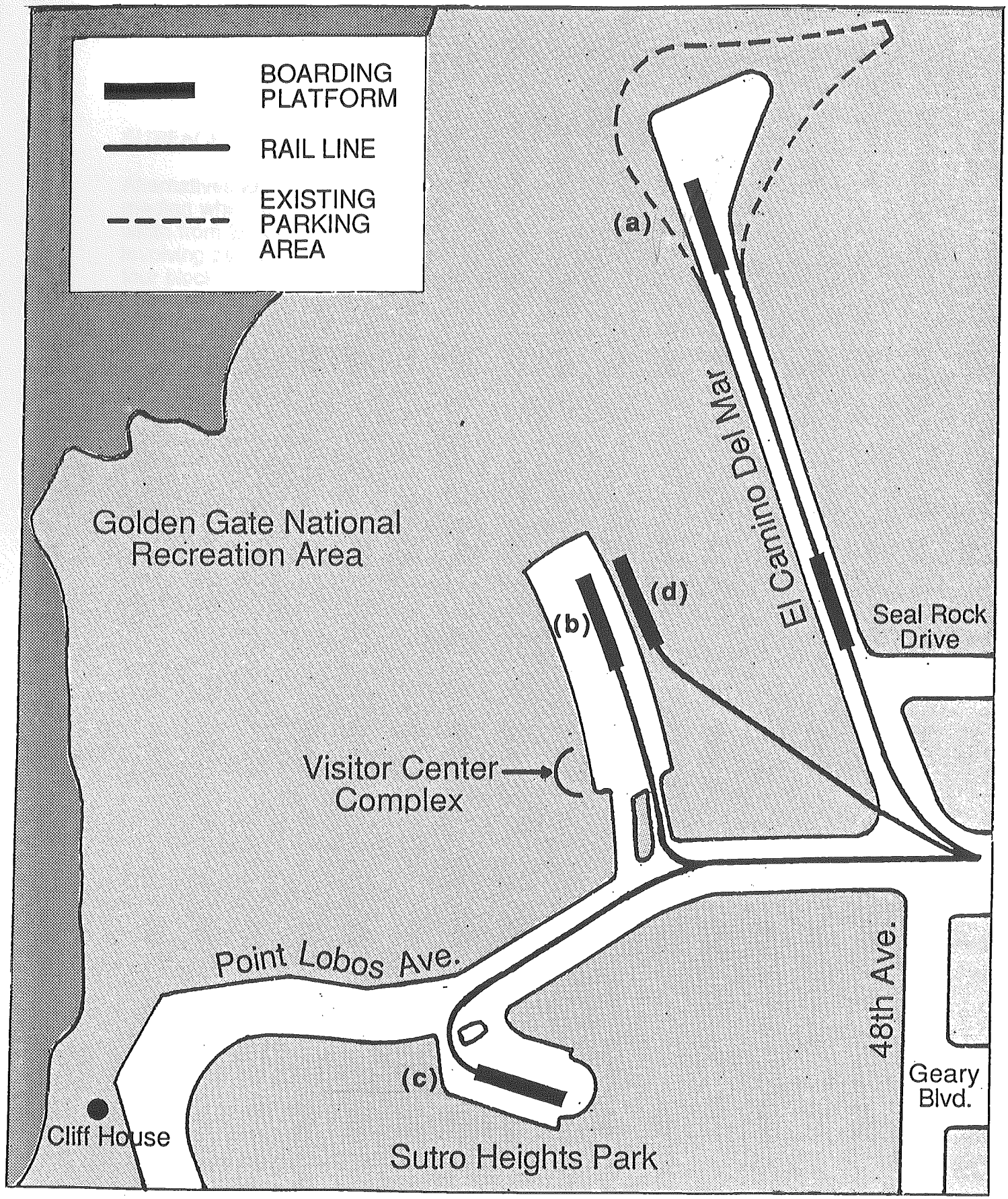
(c) Continue on Pt. Lobos through 48th Ave., past Merrie Way and turn left into the existing Sutro Heights Park parking area and terminate.

(d) From the intersection of Pt. Lobos and 48th Ave., veer off 45 degrees and proceed to just above the north end of the existing parking area on Merrie Way.

In analyzing the possibilities, consideration was given to:

- keeping track grades as flat as possible
- avoiding undue disruption of nearby streets
- minimizing the impact on the GGNRA
- historical precedent

Based upon the above, and pursuant to the GGNRA staff's recommended use of the original streetcar alignment, it appears that Site (d) is the preferred one.



Alternative Sites for Geary Rail Terminal

Figure 7

6. Other Technical Issues

SURFACE RIGHT–OF–WAY

Alternatives 2A, 2B, 3B, 3C, and 4 provide for an exclusive surface transit median which extends from 39th Avenue to Laguna. The median varies in width from 24 feet to a maximum of 34 feet. Various loading configurations involving center or side loading are possible. Stops are planned every three to four blocks; therefore, the fixed guideway may be narrowed or realigned between stops to minimize traffic and parking conflicts. Station platform length varies depending on the mode of transportation. To allow for a two–car light rail vehicle (LRV), a minimum base platform length, excluding ramps, of 150 feet is required. Low floor LRVs would require ramps a minimum of 14 feet long, while the high floor LRVs currently in service on MUNI require ramps a minimum of 30 feet long at the ends of the high platforms. Ramp length may also vary depending on topography. The typical Geary block length west of Masonic Avenue is 240 feet. This may preclude locating a left hand turn pocket and a station platform in the same block. Some of the existing left turn pockets can be relocated to adjacent blocks to meet traffic demands.

LRVs and electric trolley buses require the an overhead trolley wire system. Proper landscaping along the transit right–of–way can improve the aesthetics and mitigate any negative visual effects caused by the wires. The overhead wire system can be supported either by trolley poles located in the center of the trackway, by sidewalk poles, or it can be supported from adjacent buildings, or from a combination for the three. Underground feeder cables and substations are also required.

ELEVATED STRUCTURES

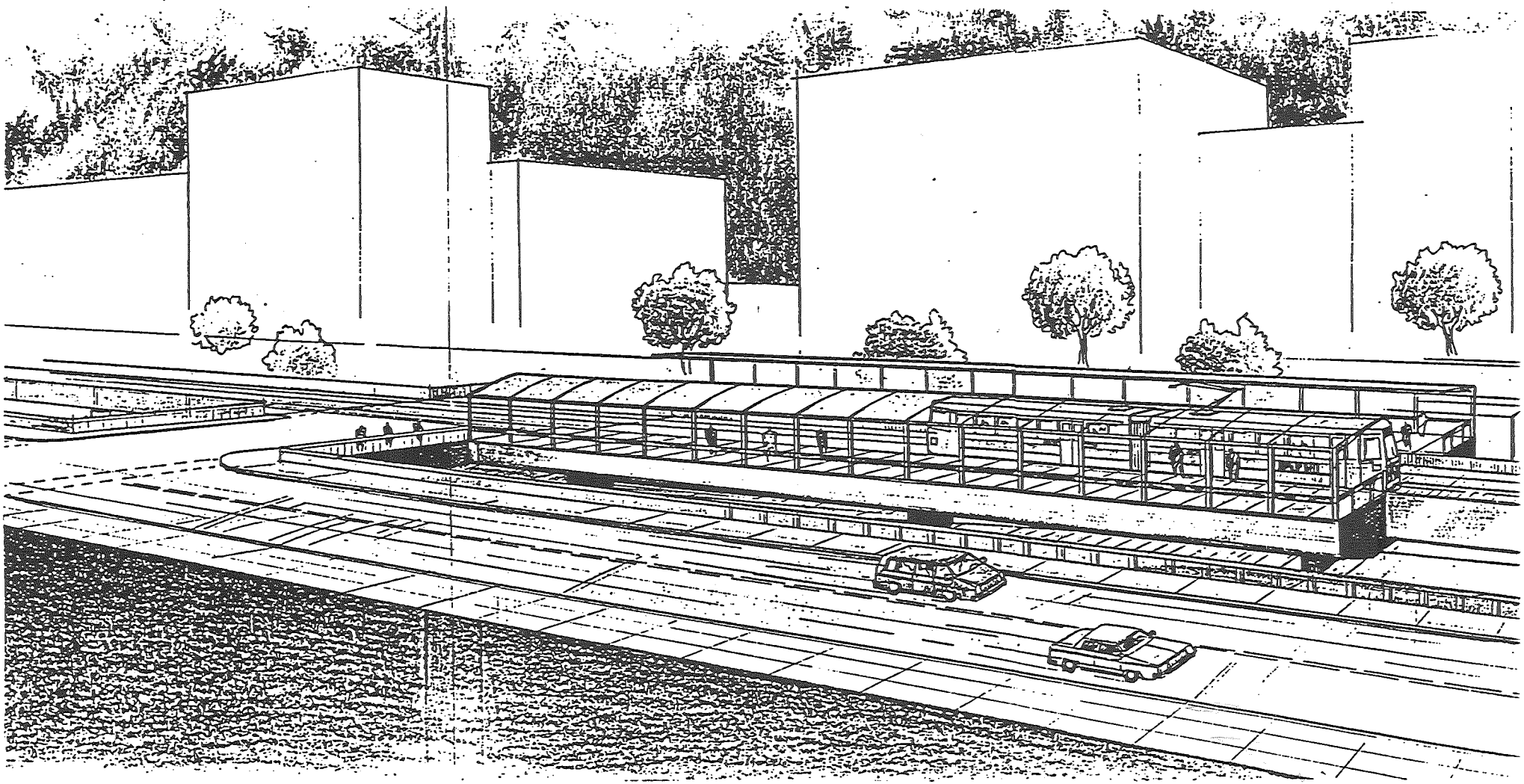
Because of the presence of automobile underpasses in the middle of Geary, between Collins and Lyon and between Steiner and Webster under the median alternatives (Alternatives 2A, 2B, 3B, 3C & 4), transit vehicles are place on transit-only viaducts in these sections.

As shown in Figure 8, keeping the transit vehicle at normal street grade (as opposed to routing them through the underpass) facilitates the placement of transit station stops at grade just east of Fillmore and just west of Presidio Avenue.

It is anticipated that the Webster-Steiner viaduct will maintain the six existing underpass lanes and two surface automobile lanes and that the Collins to Lyon viaduct will maintain existing four underpass lanes and two frontage lanes.

UNDERGROUND STRUCTURES

All alternatives except for Alternatives 1 and 4 call for construction of a subway for some portion of the route. Whether the subway is for LRVs or electric trolley buses, the dimensions and construction methods used are the same. Subways



PLATFORM AT GEARY & FILLMORE

Figure 8

for buses can be converted for LRV use and vice versa. Soft soil conditions in the downtown area require special design and construction techniques. Subway segments with sufficient soil cover can generally be constructed by tunneling, while stations and portals usually require cut and cover construction. Alternatives 2B, 3A, 3B, and 3C have a cut and cover section which crosses Market Street at Third Street.

In the Downtown area, a subsurface crossing of Market Street is feasible only at Third Street. Other locations from Second Street down towards the Ferry Building are constrained by subway stations and shallow ground above the MUNI subway tunnels. A deep tunnel crossing is possible, but cost prohibitive. Cut and cover is the method of choice to construct the crossing. As with station construction, decking over the excavated area is required to minimize traffic disruption. Extensive utility relocation work is also anticipated. The total construction time is about two to three years.

A pedestrian connector between the existing Montgomery Street Station and the proposed Geary station at Third is highly desirable because it will create a convenient transit hub for patrons. The connector can be equipped with moving sidewalks and join to the mezzanine level of the existing station.

Portals are required at surface to subway transitions. The minimum width of a single track portal is about 15 feet, a double track portal about 28.5. For a street on a relatively level grade, the portal occupies the full length of a single block, thus eliminating two to three traffic lanes depending on whether it is a single or double track portal.

7. Construction Elements and Impacts

Construction impacts are important factors to consider in selecting alternatives. The following sections cover the typical construction elements associated with the Geary Corridor "build alternatives."

SURFACE RIGHT–OF–WAY: Busway and Trackway

Trackway construction which includes an exclusive right–of–way requires extensive planning to minimize disruptions. Alternative 3A which calls for mixed–flow bus traffic has the least impact since construction work is less extensive. The construction of the overhead trolley wire system for electrification results in minor impact to surface traffic, as only occasional traffic re–routing during electrical duct bank installation is anticipated. Overhead wire support poles can be constructed within the sidewalk area.

Construction of an exclusive right–of–way for transit median operations requires traffic lane closures. Disruption can be minimized by constructing the bus way or trackway one to three blocks at a time. The cumulative impact of such construction can be minimized if sufficient distance is provided between concurrently constructed segments. Similar staging techniques have been successfully implemented on the F–Line Market Thoroughfare construction

project. The time required to construct one block excluding utility relocation is approximately one to two months. Utility relocation work can be completed prior to the start of major construction work, and usually takes three to six months for segments of eight to ten blocks in length.

ELEVATED STRUCTURES: Viaduct and Elevated Station

The elevated viaduct is about 28 feet in width, and its supporting piers are about 4 feet in diameter and spaced at 100–foot intervals. Construction activities associated with viaducts, in general, can be confined within the middle portion of the roadway. Construction of the viaducts one block at a time may help to alleviated traffic congestion. Elevated stations can be constructed with temporary false work to permit traffic underneath.

Construction time is estimated to be 12 months per block for the viaduct. Concurrent construction at different segments and usage of pre–cast sections can shorten the overall schedule. The total construction time for the viaduct and the elevated platforms is about three years.

UNDERGROUND STRUCTURES: Tunnel

Tunneling operations require working platforms housed within vertical shafts at both ends of the tunnel. Bulkhead, tunneling machinery, soil removal equipment and compressed air plant (when required) are contained within the vertical shaft area. The terminating point of the tunnel can either be a station or portal. Disruption and traffic impacts are significant at tunnel ends due to the initial construction of the shafts, and subsequent hauling away of the excavated soil. The construction of the shaft takes six to twelve months and requires partial roadway closure. The tunneling operation itself is less disruptive because all the work is done underground. Preparation before tunneling includes relocation of utilities, installation of monitoring devices to detect ground movements, maintenance of high pressure fire water lines, stabilization of soil by chemical grouting and other methods, underpinning (if required) and strengthening old buildings (especially in the downtown area with bay mud). Additionally, in order to select the right type of tunnel boring equipment and techniques, extensive soil boring for geo–technical investigation is required. These activities must be well planned and coordinated to minimize disruption. Depending on the type of soils encountered, an average of seven to fifteen feet of tunnel advance can be achieved per day. Schedule acceleration by tunneling from both ends concurrently is also possible.

UNDERGROUND STRUCTURES: Subway Stations and Portals

Underground cut and cover construction normally required for stations causes major disruption at and around the construction site. Due to the length of the station (350 feet required for three–car LRV berthing), an entire block is affected by the excavation. Traffic detours and decking over the excavated area are required to minimize disruption.

Fans are required at each end of a station for station and fire safety ventilation. Current regulations may require structures above grade to exhaust smoke 10 feet above sidewalk level and keep smoke away from pedestrians. In that event, unless off– street ventilation sites can be acquired, ventilation structures (along with station entrances), would require construction in sidewalks.

Portals require cut and cover and construction. Single track construction requires a construction zone approximately 30 feet in width; double track construction requires an area approximately 45 feet in width. Traffic re–routing may require periods of detour away from the construction site, but closing–off an entire block should not be required.

Underpinnings would be required in some areas to protect nearby structures.

Construction time for each station, including ancillary structures, is estimated to be 3 to 3.5 years. The station construction may be phased to minimize disruption of traffic. It is possible to first construct a decking over the area to be excavated, restore traffic to the decked surface and proceed with excavation under the decking. The installation of the decking may also be phased and therefore the entire street width would not be blocked at one time. Single track portals and double track portals take 12 months and 18 months to construct respectively.

UNDERGROUND STRUCTURES: Pedestrian Connectors

For Alternatives 2B, 3A, 3B & 3C incorporate an underground pedestrian walkway between the station proposed to be located on Third Street just south of Market and the west end of the Montgomery MUNI/BART station. This connector, which could be equipped with moving sidewalks, provides direct access to the mezzanine level of the Montgomery Station. The connector is located approximately 30 to 40 feet beneath the ground surface and is about 40 feet in width. Construction method and duration for the connector are similar to a station. However, utility relocation would be more extensive due to the longer length of the connector.

CONSTRUCTION IMPACT MITIGATION

As indicated, the construction program outlined above would temporarily affect street operations and, to some degree, adjacent properties. For this reason it is of critical importance to plan ahead and to stage the various construction elements carefully and to keep affected parties fully informed of on-coming events ahead of time Community involvement and inputs during planning, design, and construction stages are therefore invaluable. The Upper Market Thoroughfare project has demonstrated that cooperation between the public, the City, and the contractors has brought project success.

The construction of surface tracks, medians, viaducts and loading platforms will require extensive traffic routing. Staged construction that confines the work to one to three blocks at a time minimizes the impact. For the most part, business,

public and private establishment access can be kept fully accessible throughout the construction period.

The construction of Market Street crossing, underground stations, tunnel shafts, and portals involve major excavations. All affected utility lines would be relocated prior to the installation of shoring system such as soldier piles, slurry walls or sheet piles. "Top down" construction can be utilized by providing temporary or permanent decking at an early stage, hence excavation and construction activities can take place underneath the deck without adversely affecting traffic at the street level.

SUMMARY

The construction durations and impacts for each alternative are summarized in Table 2.

Table 2 Construction Durations and Impacts

Alternatives	Construction Duration (years)	Disruption and Impacts	Remarks
1. TSM	1	minimal	off–hour installation of traffic pre–emption system
2A. Geary/Market Light Rail Subway and Surface Line	4 to 6	1. Closure of traffic lanes for surface line construction 2. Subway Station block may be disrupted for extended period of time	Concurrent construction of both surface line and subway line. Surface line including viaducts takes 3 years; tunneling and stations 4 to 6 years
2B. Geary/3rd/ Howard Light Rail Subway and Surface Line	4 to 6	1. Closure of traffic lanes for surface line construction 2. Subway Station block may be disrupted for extended period of time	Concurrent construction of both surface line and subway line. Surface line including viaducts takes 3 years; tunneling and stations 4 to 6 years

Construction Durations and Impacts (Cont.)

Alternatives	Construction Duration (years)	Disruption and Impacts	Remarks
3A. Electric Trolley Bus/Dual Mode Bus Subway and Surface Line	4 to 6	1. Minimal re– routing of traffic for wire installation 2. Subway tunnel and station construction is similar to alt. 2A & 3B	Construction time is driven by the subway portion of the work. Surface line can be implemented in 2 years
3B. Electric Trolley Bus Subway/ Surface Line (long tunnel)	6	essentially the same as alt. 3A	see alt. 3A
3C. Electric Trolley Bus Subway/ Surface Line (short tunnel)	3 to 5	same as alt. 3A	Construction time is shorter due to shorter tunnel construction
4. Surface Light Rail Line	3	closure of traffic lanes required for the construction of trackway and median	Concurrent construction of at least three segments is assumed

III. STUDY RESULTS

A. Travel Time Savings

As indicated in Section II H, each of the seven alternatives incorporates features designed to speed up the flow of transit vehicles. A comparison of the one way travel times of the seven alternatives is presented in Table 3.

The TSM alternative provides for the pre-emption of certain traffic signals to give buses priority over other traffic.

Alternative 2A facilitates better travel speeds by placing light rail vehicles (LRVs) on their own transit-only median between 39th Avenue and Laguna and then in subway from Laguna to the foot of O'Farrell and Geary.

Alternative 2B is similar except that under Alternative 2B, the LRV subway continues under Third and Howard to Beale Street.

Under Alternative 3A, electric trolley buses travel in mixed flow traffic to Laguna where they enter a subway routed the same as it is routed under Alternate 2B.

Alternative 3B places electric trolley buses in a transit-only median as under Alternatives 2A and 2B, and in subway as is done under Alternative 2B.

Alternative 3C is similar to 3B except that electric buses travel in mixed flow traffic from the east end of the median at Laguna to Taylor, where they enter a subway which follows the same south-of-Market route as Alternatives 2B, 3A and 3B.

Alternative 4 also includes a median for light rail vehicles between 39th Avenue and Gough. Under Alternative 4, LRVs continue in mixed flow traffic from Gough via Geary, Market and First to the Transbay Terminal. Extensive street modifications are made under this alternative to increase transit speeds and improve reliability.

The one-way travel times of the seven alternatives between 48th Avenue and Sansome and Market are shown in Table 3. Times include on-vehicle and off vehicle times, arranged so that the alternatives can be compared to one another and to the existing condition.

As can be seen from the table, the six "build" alternatives cut travel times from 8 to 20 minutes (equivalent to a 15 to 40% reduction) below current local bus times.

Six elements that are present the some or all of the "build" alternatives combine to reduce travel times; namely the TSM improvements, the low floor vehicles (which speed up loading and unloading), the proof-of-payment fare collection system (which speeds up loading), the slightly wider spacing between transit stops, the transit-only surface median, the subway and other street

Geary Corridor Study
Estimate of Travel Times w/ Proof of Payment (1)
48th Ave to Sansome/Market

Travel Time per Segment

		SUBWAY	WEST (2) SURFACE MEDIAN	EAST (2) SURFACE MEDIAN	DIAMOND LANE	MARKET ST SURFACE MIXED	LAGUNA-39th SURFACE MIXED	39th-48th SURFACE MIXED (3)	WALK	TRANSIT MALL	EXISTING SURFACE	TOTAL TRAVEL TIME
Existing 38 (4)											49.00	49.0
Existing 38L (4)											40.00	40.0
Alt #	MODE											
2A	Light Rail	4.18	15.70	3.83		1.89		3.00				28.6
2B	Light Rail	4.53	15.70	3.83				3.00	2.00			29.1
3A	Trolley Bus	5.20					30.75	3.00	2.00			41.0
3B	Trolley Bus	5.20	16.42	4.00				3.00	2.00			30.6
3C	Trolley Bus	1.60	16.42	4.73	7.00			3.00	2.00			34.7
4	Light Rail		15.70	4.52		9.45		3.00		1.64		34.3

(1) Proof of Payment increases median operating speed by 15% for LRV and 10% for buses.

(2) West and East division is at Masonic.

(3) Time slower in this segment compared to ver3 as we no longer assume using proof of payment.

(4) Approximate travel times using the 1994 MUNI Winter schedule.

April 10, 1995

Table 3

improvements (such as those proposed under Alternative 4) designed to speed up service.

Additional information about the median operation can be found in Section II L.

Additional information about the street changes proposed under Alternative 4 can be found in Appendix C.

B. Patronage

Because of the limited budget available for patronage forecasting, it was not possible to develop a bona fide patronage forecasting model for this project. However, using the regional trip tables prepared and developed by the Metropolitan Transportation Commission, it was possible to develop a reasonably accurate picture of the Year 2010 patronages projected for each of the seven alternatives.

Patronage forecasting results are shown in Figure 9 and Table 4. As shown in the table, when both a median along Outer Geary and a subway operation through downtown San Francisco is provided (Alternatives 2A, 2B, 3B, and 3C), Geary boardings range from 73,900 to 79,900, with 3C, the short subway electric trolley bus operation generating the least patronage, and 3B, the long subway electric bus operation the most.

When the subway but not the median is removed (as in Alternative 4), the boarding level drops to 69,900. When the median but not the subway is removed (as in Alternative 3A), the level drops even further to 66,800.

When neither the median nor the subway is provided (per the TSM alternative), patronage drops still further to 62,700.

Based upon the preliminary findings of this study, it appears that the electric trolley bus subway/surface alternatives would generate about the same patronage as the equivalent subway/surface light rail alternatives.

Because of the already heavy use of MUNI on the part of Geary Corridor travelers, none of the alternatives generates a large amount of new patronage. In all cases, most of the new Geary boardings shown in the table result from a diversion of MUNI bus users from the existing 38 lines, as well as from other near-by MUNI bus routes. As shown in the table, the new transit person trips range from 200 per day to 3,000 per day depending upon the alternative.

For additional information about the patronage forecasting assumptions and methodology used in the Geary Corridor System Planning Study, see Appendix E and Working Paper #5.

Geary Corridor

Comparison of Daily Ridership - Year 2010

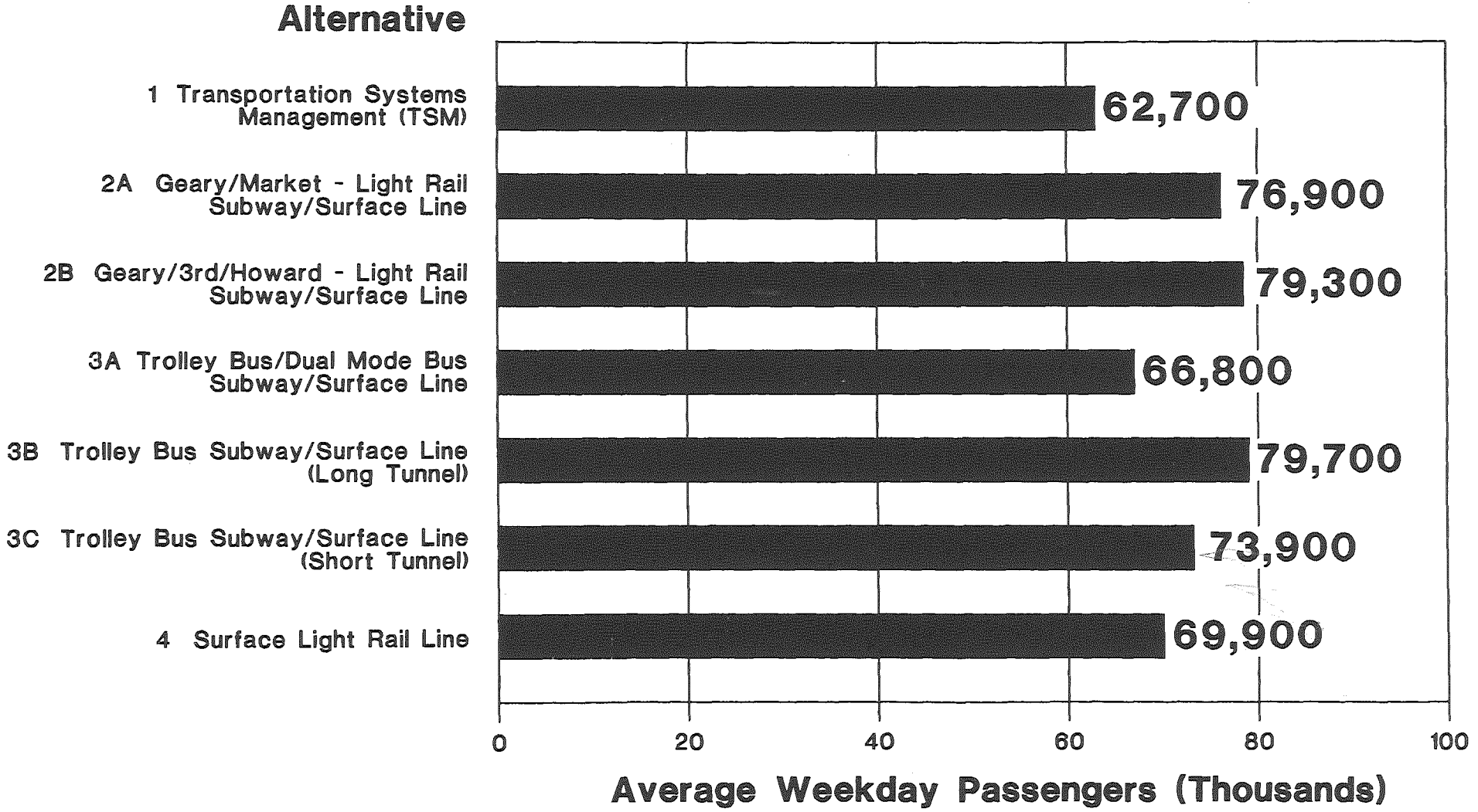


Figure 9

DAILY PATRONAGE:
RESULTS FOR THE YEAR 2010

Alternative	GEARY CORRIDOR		GEARY BOULEVARD		Dollars Saved[3]	Hours Saved[4]
	Total Transit Person Trips[1]	New Transit Person Trips[1,2]	Total Geary Boardings	New Geary Boardings[2]		
Existing	118,200	-	61,200	-	-	-
TSM	118,400	200	62,700	1,500	-	-
2A	120,500	2,300	76,900	15,700	$18,600	4,780
2B	121,200	3,000	79,300	18,100	$23,800	6,000
3A	119,400	1,200	66,800	5,600	$9,500	2,650
3B	121,200	3,000	79,700	18,500	$23,300	6,800
3C	120,400	2,200	73,900	12,700	$16,900	4,930
4	119,500	1,300	69,900	8,700	$10,800	2,550

Source: Parsons Brinckerhoff - November 1994

[1]One way trips
[2]Compared to existing
[3]Daily dollar savings of transit users (at $4.80/hr. for work trips and $2.40/hr. for non-work trips), compared to the TSM Alternative.
[4]Daily time saved by transit users compared to the TSM Alternative

Table 4

C. Costs

Capital Costs:

Comprehensive capital cost estimates including design, right-of-way acquisition, underpinning of affected nearby structures and construction of the proposed facilities, all calculated in 1994 dollars, are shown in Figure 10 and in Tables 5A to 5G. A more complete description of the assumptions and methodology underlying the capital cost estimates is presented in Working Paper #4.

Operating and Maintenance Costs:

Annual operating and maintenance (O&M) costs were developed for each of the alternatives. Costs were calculated by applying MUNI's latest official bus and light rail unit costs to Geary Corridor operating variables developed separately for each of the alternatives.

The unit costs and operating variables are shown in Table 6.

Unit costs were adapted from MUNI's official cost breakdown as included in the 1993 edition of MUNI's Section 15 Report to the Federal Transportation Administration.

The operating variables consist of the vehicle miles per year, vehicle hours per year, number of buses, length of line and number of subway stations.

To determine transit operating variables, it is first necessary to develop a transit operating plan. This is done by defining the transit route, number of subway stations and then determining the number of transit runs based upon average speeds and frequencies of service balanced against anticipated demand. Through an "equilibration" process, frequencies are adjusted to reflect anticipated ridership on a trial and error basis.

With the number of runs, average speeds and distances established for a given alternative, it is a relatively straightforward exercise to calculate number of vehicles, vehicle miles and vehicle hours for that alternative.

O&M cost estimating results are shown in Figure 11 and in more detail in Table 6. For a description of the Operating Plans used to calculate the variable quantities, see Appendix D.

Cost Effectiveness Indices (CEIs):

A Cost Effectiveness Index as defined by the Federal Transit Administration (FTA) is a measure of the financial feasibility of a fixed guideway proposal. It is based upon the difference in benefit between a "build" alternative and the TSM alternative. The variables included in the CEI formula are the capital cost, operating and maintenance cost, travel time saved by existing transit riders and

number of new transit riders. Two forms of the index are used. Both are expressed in terms of net dollars of additional cost per new rider.

Because of the difficulty of applying the Cost Effectiveness Index (CEI) fairly to each of the various regional proposals competing for federal transit development funds, the federal government is rethinking its project evaluation criteria at this time. It is unlikely that the Index will be as important a funding determinant in the future as it has been in the past. The CEI of the seven alternatives are shown in Table 7.

For additional detail about how cost effectiveness indices are calculated, see Working Paper #6.

Geary Corridor
Comparison of Capital Costs

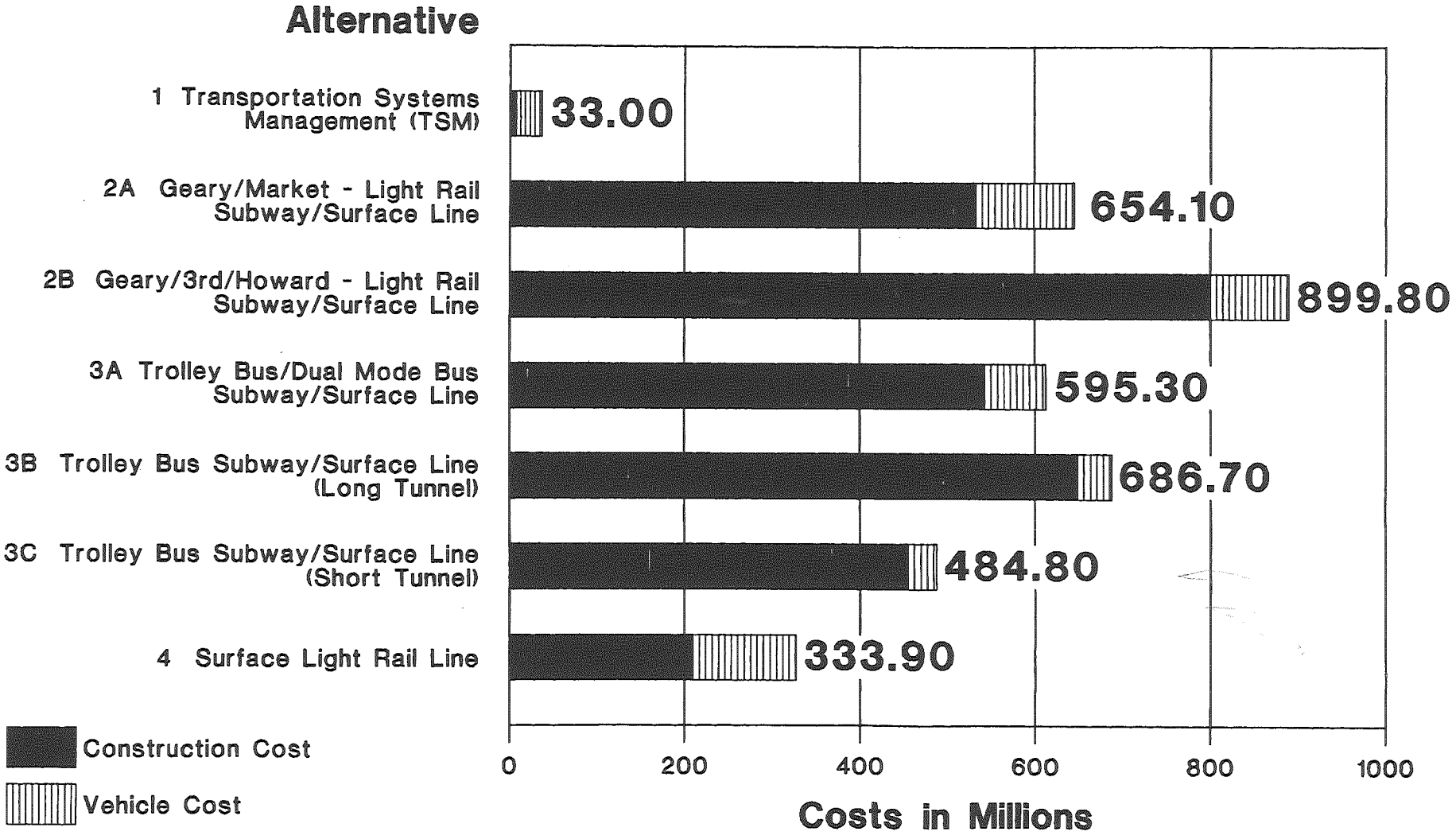


Figure 10

Geary Corridor Transit Study Alternative Unit Prices

ALTERNATIVE 1

Alternative 1 TSM

	Item	Unit	Price	Quantity	Subtotal	Economic Life	Remarks
	TRANSPORTATION SYSTEM MANAGEMENT						
1	Governmental Utility Relocation	Route Mile	$3,000,000	0	$0	30 years	
2	Street Reconstruction- w/LRT in Street	Route Mile	$3,500,000	0	$0	20 years	
3	Traffic Routing	Route Mile	$500,000	0	$0		
4	LRT Track & Roadbed- Embedded Track in Pavement	Track Mile	$1,600,000	0	$0	30 years	
5	LRT Track & Roadbed- Direct Fixation W/Plain Concrete	Track Mile	$1,400,000	0	$0	30 years	
6	LRT Special Work - Crossover	Each	$250,000	0	$0	30 years	
7	Structures - Viaduct	Route Foot	$4,000	0	$0	30 years	
8	Structures - Standard Tunnel	Track Foot	$11,000	0	$0	30 years	
9	Structures - Tunnels in Soft Soil	Track Foot	$15,000	0	$0	30 years	
10	Structures - Portals	Each	$5,700,000	0	$0	30 years	
11	Boarding Islands - Surface-Median,	Each	$85,000	0	$0	30 years	
12	LRT Stations - Surface-Median, 175' Platform	Each	$285,000	0	$0	30 years	
13	BART Subway Station	Each	N/A	0	$0	30 years	
14	LRT Subway Station	Each	$15,000,000	0	$0	30 years	
15	LRT Elevated Station	Each	$2,000,000	0	$0	30 years	
16	Streetscape, Landscape, Etc.	Route Mile	$2,000,000	0	$0	20 years	
17	Civil & ROW Subtotal			0	$0		
18	Overhead Contact System	Track/Lane Mile	$500,000	0	$0	30 years	
19	Substation - LRT (Land not included)	Each	$1,000,000	0	$0	30 years	
20	Substation - Trolley Bus (Land not included)	Each	$800,000	0	$0	30 years	
21	Traction Power System	Route Mile	$750,000	0	$0	30 years	
22	Communications	Platform	$10,000	0	$0	30 years	
23	Street Lighting	Route Mile	$150,000	0	$0	30 years	
24	Block Signals/Power Switches	Route Mile	$750,000	0	$0	30 years	
25	Traffic Signal & Pre-empts	Intersection	$50,000	49	$2,450,000	30 years	
26	Fare Collection/ Vending Machines	Per Platform	$50,000	0	$0	30 years	Allow 2 per station
27	System Support Subtotal				$2,450,000		
28	SUBTOTAL				$2,450,000		
	Transit Vehicles						
29	LRV	Each	$2,700,000		$0	25 years	
30	Rapid Transit	Each	N/A		$0	25 years	
31	Articulated Trolley Bus	Each	$675,000		$0	18 years	
32	Dual Mode Bus	Each	$725,000		$0	15 years	
33	Diesel Articulated Bus	Each	$400,000	67	$26,800,000	12 years	Peak demand + 15%
34	Vehicle Subtotal				$26,800,000		
35	Engineering & Administration Costs	%Other Costs	0.25		$612,500	30 years	25% of item 28
	Contingencies						
36	Civil & ROW	% Costs	0.3		$0	30 years	30% of item 17
37	System Support	% Costs	0.2		$490,000	30 years	20% of item 27
38	Vehicles	% Costs	0.1		$2,680,000	varies	10% of item 34
39	TOTAL				$33,033,000		

Cost estimates are in 1994 dollars.

(4/95)

Table 5A

Geary Corridor Transit Study Alternative Unit Prices

Light Rail Alternatives 2A

	Item	Unit	Price	Alternative 2A Subway Laguna to Union Sq. Quantity	Subtotal	Economic Life	Remarks
	LIGHT RAIL TRANSIT OPTIONS						
1	Government Utility Relocation	Route Mile	$3,000,000	6.41	$19,230,000	30 years	
2	Street Reconstruction- w/LRT in Street	Route Mile	$3,500,000	5.71	$19,985,000	20 years	Equiv. to 0.2 miles per station
3	Traffic Routing	Route Mile	$500,000	5.71	$2,855,000		Equiv. to 0.2 miles per station
4	LRT Track & Roadbed- Embedded Track in Pavement	Track Mile	$1,600,000	8.2	$13,120,000	30 years	
5	LRT Track & Roadbed- Direct Fixation W/Plain Concrete	Track Mile	$1,400,000	4.8	$6,720,000	30 years	
6	LRT Special Work - Crossover	Each	$250,000	3	$750,000	30 years	
7	Structures - Viaduct	Route Foot	$4,000	5400	$21,600,000	30 years	
8	Structures - Standard Tunnel	Track Foot	$11,000	13650	$150,150,000	30 years	
9	Structures - Tunnels in Soft Soil	Track Foot	$15,000	0	$0	30 years	
10	Structures - Double Portals	Each	$3,510,000	1	$3,510,000	30 years	
10a	Structures - Single Portals	Each	$3,010,000	2	$6,020,000	30 years	
11	Loading Islands- Surface-Median	Each	$85,000	0	$0	30 years	
12	LRT Stations - Surface-Median, 175' Platform	Each	$285,000	13	$3,705,000	30 years	
13	BART Subway Station	Each	N/A	0	$0	30 years	
14	LRT Subway Station	Each	$15,000,000	4	$60,000,000	30 years	3 car station approx. 350' long
15	LRT Elevated Station	Each	$2,000,000	3	$6,000,000	30 years	
16	Streetscape, Landscape, Etc.	Route Mile	$2,000,000	5.11	$10,220,000	20 years	
17	Civil & ROW Subtotal				$323,865,000		
18	Overhead Contact System	Track/Lane Mile	$500,000	12.82	$6,410,000	30 years	
19	Substation - LRT (Land not included)	Each	$1,000,000	2	$2,000,000	30 years	
20	Substation - Trolley Bus (Land not included)	Each	$800,000	0	$0	30 years	
21	Traction Power System	Route Mile	$750,000	6.41	$4,807,500	30 years	
22	Communications	Platform	$10,000	20	$200,000	30 years	
23	Street Lighting	Route Mile	$150,000	5.11	$766,500	30 years	
24	Block Signals/Power Switches	Route Mile	$750,000	1.3	$975,000	30 years	
25	Traffic Signal & Pre-empts	Intersection	$50,000	34	$1,700,000	30 years	
26	Fare Collection/Vending Machines	Per Platform	$50,000	40	$2,000,000	30 years	2 allowed per station
27	System Support Subtotal				$18,859,000		
28	SUBTOTAL				$342,724,000		
	Transit Vehicles						
29	LRV	Each	$2,700,000	42	$113,400,000	25 years	Req'd number + 15% spares
30	Rapid Transit	Each	N/A		$0	25 years	
31	Articulated Trolley Bus	Each	$675,000		$0	18 years	
32	Dual Mode Bus	Each	$725,000		$0	15 years	
33	Vehicle Subtotal				$113,400,000		
34	Engineering & Administration Costs	%Other Costs	0.25		$85,681,000	30 years	25% of item 28
	Contingencies						
35	Civil & ROW	% Costs	0.3		$97,159,500	30 years	30% of item 17
36	System Support	% Costs	0.2		$3,771,800	30 years	20% of item 27
37	Vehicles	% Costs	0.1		$11,340,000	varies	10% of item 33
38	TOTAL				$654,076,000		

Cost estimates are in 1994 dollars.

Alternative costs assume a shallow crossing at Market. For a deep tunnel add an additional $100 million to the cost.

(4/95)

Table 5B

Geary Corridor Transit Study Alternative Unit Prices

Light Rail Alternatives 2B

	Item	Unit	Price	Alternative 2B Subway Laguna to Howard/Beale Quantity	Subtotal	Alternative 2B- Extension Quantity	Subtotal	Economic Life	Remarks
	LIGHT RAIL TRANSIT OPTIONS								
1	Government Utility Relocation	Route Mile	$3,000,000	6.61	$19,830,000	0.73	$2,190,000	30 years	
2	Street Reconstruction- w/LRT in Street	Route Mile	$3,500,000	5.67	$19,845,000	0.6	$2,100,000	20 years	Equiv. to 0.2 miles per station
3	Traffic Routing	Route Mile	$500,000	5.67	$2,835,000	0.6	$300,000		Equiv. to 0.2 miles per station
4	LRT Track & Roadbed- Embedded Track in Pavement	Track Mile	$1,600,000	6.91	$11,056,000	0	$0	30 years	
5	LRT Track & Roadbed- Direct Fixation W/Plain Concrete	Track Mile	$1,400,000	6.52	$9,128,000	1.1	$1,540,000	30 years	
6	LRT Special Work - Crossover	Each	$250,000	3	$750,000	0	$0	30 years	
7	Structures - Viaduct	Route Foot	$4,000	5400	$21,600,000	0	$0	30 years	
8	Structures - Standard Tunnel	Track Foot	$11,000	15000	$165,000,000	0	$0	30 years	
9	Structures - Tunnels in Soft Soil	Track Foot	$15,000	7600	$114,000,000	5700	$85,500,000	30 years	
10	Structures - Double Portals	Each	$3,510,000	1	$3,510,000	0	$0	30 years	
10a	Structures - Single Portals	Each	$3,010,000	0	$0	2	$6,020,000	30 years	
11	Loading Islands- Surface-Median	Each	$85,000	0	$0	0	$0	30 years	
12	LRT Stations - Surface-Median, 175' Platform	Each	$285,000	13	$3,705,000	0	$0	30 years	
13	BART Subway Station	Each	N/A	0	$0	0	$0	30 years	700 ' long stations through-out
14	LRT Subway Station	Each	$15,000,000	7	$105,000,000	1	$15,000,000	30 years	3 car station approx. 350' long
15	LRT Elevated Station	Each	$2,000,000	3	$6,000,000	0	$0	30 years	Add 1 stn for ped conn.
16	Streetscape, Landscape, Etc.	Route Mile	$2,000,000	4.47	$8,940,000	0	$0	20 years	
17	Civil & ROW Subtotal				$491,199,000		$112,650,000		
18	Overhead Contact System	Track/Lane Mile	$500,000	13.22	$6,610,000	1.1	$550,000	30 years	
19	Substation - LRT (Land not included)	Each	$1,000,000	2	$2,000,000	0	$0	30 years	
20	Substation - Trolley Bus (Land not included)	Each	$800,000	0	$0	0	$0	30 years	
21	Traction Power System	Route Mile	$750,000	6.61	$4,957,500	0.73	$547,500	30 years	
22	Communications	Platform	$10,000	23	$230,000	1	$10,000	30 years	
23	Street Lighting	Route Mile	$150,000	4.47	$670,500	0	$0	30 years	
24	Block Signals/Power Switches	Route Mile	$750,000	2.14	$1,605,000	0.73	$547,500	30 years	
25	Traffic Signal & Pre-empts	Intersection	$50,000	32	$1,600,000	0	$0	30 years	
26	Fare Collection/Vending Machines	Per Platform	$50,000	40	$2,000,000	2	$100,000	30 years	2 allowed per station
27	System Support Subtotal				$19,673,000		$1,755,000		
28	SUBTOTAL				$510,872,000		$114,405,000		
	Transit Vehicles								
29	LRV	Each	$2,700,000	37	$99,900,000		$0	25 years	Peak need +15% spares
30	Rapid Transit	Each	N/A		$0		$0	25 years	
31	Articulated Trolley Bus	Each	$675,000		$0		$0	18 years	
32	Dual Mode Bus	Each	$725,000		$0		$0	15 years	
33	Vehicle Subtotal				$99,900,000		$0		
34	Engineering & Administration Costs	%Other Costs	0.25		$127,718,000		$28,601,250	30 years	25% of item 28
	Contingencies								
35	Civil & ROW	% Costs	0.3		$147,359,700		$33,795,000	30 years	30% of item 17
36	System Support	% Costs	0.2		$3,934,600		$351,000	30 years	20% of item 27
37	Vehicles	% Costs	0.1		$9,990,000		$0	varies	10% of item 33
38	TOTAL				$899,774,000		$177,152,000		

Cost estimates are in 1994 dollars.

(4/95)

Alternative costs assume a shallow crossing at Market. For a deep tunnel add an additional $100 million to the cost.

Table 5C

Geary Corridor Transit Study Alternative Unit Prices

	Item	Unit	Price	Alternative 3A ETB Mixed flow west of Laguna Quantity	Subtotal	Economic Life	Remarks
	ELECTRIC TROLLEY BUS TRANSIT OPTIONS						
1	Government Utility Relocation	Route Mile	$3,000,000	1.83	$5,490,000	30 years	
2	Street Reconstruction- w/LRT in Street	Route Mile	$3,500,000	1.25	$4,375,000	20 years	Equiv. of 0.2 miles per subway station
3	Traffic Routing	Route Mile	$500,000	1.25	$625,000		Equiv. of 0.2 miles per subway station
4	LRT Track & Roadbed- Embedded Track in Pavement	Track Mile	$1,600,000	0	$0	30 years	
5	LRT Track & Roadbed- Direct Fixation W/Plain Concrete	Track Mile	$1,400,000	0	$0	30 years	
6	LRT Special Work - Crossover	Route Mile	$250,000	0	$0	30 years	
7	Structures - Viaduct	Route Foot	$4,000	0	$0	30 years	
8	Structures - Standard Tunnel	Track Foot	$11,000	15000	$165,000,000	30 years	
9	Structures - Tunnels in Soft Soil	Track Foot	$15,000	4300	$64,500,000	30 years	
10	Structures - Double Portals	Each	$3,510,000	1	$3,510,000	30 years	
10a	Structures - Single Portals	Each	$3,010,000	2	$6,020,000	30 years	
11	Loading Islands - Surface-Median	Each	$85,000	0	$0	30 years	
12	LRT Stations - Surface-Median,175' Platform	Each	$285,000	0	$0	30 years	
13	BART Subway Station	Each	N/A	0	$0	30 years	
14	LRT Subway Station	Each	$15,000,000	6	$90,000,000	30 years	Ped. connection add 1 station
15	LRT Elevated Station	Each	$2,000,000	0	$0	30 years	
16	Streetscape, Landscape, Etc.	Route Mile	$2,000,000	0.75	$1,500,000	20 years	
17	**Civil & ROW Subtotal**				$341,020,000		
18	Overhead Contact System	Track/Lane Mile	$500,000	13.2	$6,600,000	30 years	
19	Substation - LRT (Land not included)	Each	$1,000,000	0	$0	30 years	
20	Substation - Trolley Bus (Land not included)	Each	$800,000	2	$1,600,000	30 years	
21	Traction Power System	Route Mile	$750,000	6.6	$4,950,000	30 years	
22	Communications	Platform	$10,000	4	$40,000	30 years	
23	Street Lighting	Route Mile	$150,000	4.78	$717,000	30 years	
24	Block Signals/Power Switches	Route Mile	$750,000	1.83	$1,372,500	30 years	
25	Traffic Signal & Pre-empts	Intersection	$50,000	0	$0	30 years	
26	Fare Collection/ Vending Machine	Per Platform	$50,000	8	$400,000	30 years	
27	**System Support Subtotal**				$15,679,500		
28	SUBTOTAL				$356,699,500		
	Transit Vehicles						
29	LRV	Each	$2,700,000		$0	25 years	
30	Rapid Transit	Each	N/A		$0	25 years	
31	Articulated Trolley Bus	Each	$675,000	27	$18,225,000	18 years	Peak need + 15% spares
32	Dual Mode Bus	Each	$725,000	30	$21,750,000	15 years	
33	**Vehicle Subtotal**				$39,975,000		
34	Engineering & Administration Costs	%Other Costs	0.25		$89,174,875	30 years	25% of item 28
	Contingencies						
35	Civil & ROW	% Costs	0.3		$102,306,000	30 years	30% of item 17
36	System Support	% Costs	0.2		$3,135,900	30 years	20% of item 27
37	Vehicles	% Costs	0.1		$3,997,500	varies	10% of item 33
38	TOTAL				$595,289,000		

Cost estimates are in 1994 dollars.
Alternative costs assume a shallow crossing at Market. For a deep tunnel add an additional $100 million to the cost.

(4/95)

Table 5D

Geary Corridor Transit Study Alternative Unit Prices

				Alternative 3B ETB Median operation W of Laguna			
	Item	Unit	Price	Quantity	Subtotal	Economic Life	Remarks
	ELECTRIC TROLLEY BUS TRANSIT OPTIONS						
1	Government Utility Relocation	Route Mile	$3,000,000	2.95	$8,850,000	30 years	
2	Street Reconstruction- w/LRT in Street	Route Mile	$3,500,000	5.98	$20,930,000	20 years	Equiv. of 0.2 miles per subway station
3	Traffic Routing	Route Mile	$500,000	5.98	$2,990,000		Equiv. of 0.2 miles per subway station
4	LRT Track & Roadbed- Embedded Track in Pavement	Track Mile	$1,600,000	0	$0	30 years	
5	LRT Track & Roadbed- Direct Fixation W/Plain Concrete	Track Mile	$1,400,000	0	$0	30 years	
6	LRT Special Work - Crossover	Route Mile	$250,000	0	$0	30 years	
7	Structures - Viaduct	Route Foot	$4,000	5400	$21,600,000	30 years	
8	Structures - Standard Tunnel	Track Foot	$11,000	15000	$165,000,000	30 years	
9	Structures - Tunnels in Soft Soil	Track Foot	$15,000	4300	$64,500,000	30 years	
10	Structures - Double Portals	Each	$3,510,000	1	$3,510,000	30 years	
10a	Structures - Single Portals	Each	$3,010,000	2	$6,020,000	30 years	
11	Loading Islands - Surface-Median	Each	$85,000	26	$2,210,000	30 years	
12	LRT Stations - Surface-Median,175' Platform	Each	$285,000	0	$0	30 years	
13	BART Subway Station	Each	N/A	0	$0	30 years	
14	LRT Subway Station	Each	$15,000,000	6	$90,000,000	30 years	Ped. connection add 1 station
15	LRT Elevated Station	Each	$2,000,000	3	$6,000,000	30 years	
16	Streetscape, Landscape, Etc.	Route Mile	$2,000,000	4.78	$9,560,000	20 years	
17	**Civil & ROW Subtotal**				$401,170,000		
18	Overhead Contact System	Track/Lane Mile	$500,000	13.2	$6,600,000	30 years	
19	Substation - LRT (Land not included)	Each	$1,000,000	0	$0	30 years	
20	Substation - Trolley Bus (Land not included)	Each	$800,000	2	$1,600,000	30 years	
21	Traction Power System	Route Mile	$750,000	6.6	$4,950,000	30 years	
22	Communications	Platform	$10,000	21	$210,000	30 years	
23	Street Lighting	Route Mile	$150,000	4.78	$717,000	30 years	
24	Block Signals/Power Switches	Route Mile	$750,000	1.83	$1,372,500	30 years	
25	Traffic Signal & Pre-empts	Intersection	$50,000	32	$1,600,000	30 years	
26	Fare Collection/ Vending Machine	Per Platform	$50,000	42	$2,100,000	30 years	
27	**System Support Subtotal**				$19,149,500		
28	SUBTOTAL				$420,319,500		
	Transit Vehicles						
29	LRV	Each	$2,700,000		$0	25 years	
30	Rapid Transit	Each	N/A		$0	25 years	
31	Articulated Trolley Bus	Each	$675,000	50	$33,750,000	18 years	Peak need + 15% spares
32	Dual Mode Bus	Each	$725,000		$0	15 years	
33	**Vehicle Subtotal**				$33,750,000		
34	Engineering & Administration Costs	%Other Costs	0.25		$105,079,875	30 years	25% of item 28
	Contingencies						
35	Civil & ROW	% Costs	0.3		$120,351,000	30 years	30% of item 17
36	System Support	% Costs	0.2		$3,829,900	30 years	20% of item 27
37	Vehicles	% Costs	0.1		$3,375,000	varies	10% of item 33
38	TOTAL				$686,705,000		

Cost estimates are in 1994 dollars.

Alternative costs assume a shallow crossing at Market. For a deep tunnel add an additional $100 million to the cost.

(4/95)

Table 5E

Geary Corridor Transit Study Alternative Unit Prices

	Item	Unit	Price	Alternative 3C ETB Median Operation W of Taylor Quantity	Subtotal	Economic Life	Remarks
	ELECTRIC TROLLEY BUS TRANSIT OPTIONS						
1	Government Utility Relocation	Route Mile	$3,000,000	2.12	$6,360,000	30 years	
2	Street Reconstruction- w/LRT in Street	Route Mile	$3,500,000	5.65	$19,775,000	20 years	Equiv. of 0.2 miles per subway station
3	Traffic Routing	Route Mile	$500,000	5.65	$2,825,000		Equiv. of 0.2 miles per subway station
4	LRT Track & Roadbed- Embedded Track in Pavement	Track Mile	$1,600,000	0	$0	30 years	
5	LRT Track & Roadbed- Direct Fixation W/Plain Concrete	Track Mile	$1,400,000	0	$0	30 years	
6	LRT Special Work - Crossover	Route Mile	$250,000	0	$0	30 years	
7	Structures - Viaduct	Route Foot	$4,000	5400	$21,600,000	30 years	
8	Structures - Standard Tunnel	Track Foot	$11,000	5850	$64,350,000	30 years	
9	Structures - Tunnels in Soft Soil	Track Foot	$15,000	4300	$64,500,000	30 years	
10	Structures - Double Portals	Each	$3,510,000	0	$0	30 years	
10a	Structures - Single Portals	Each	$3,010,000	4	$12,040,000	30 years	
11	Loading Islands - Surface-Median	Each	$85,000	26	$2,210,000	30 years	
12	LRT Stations - Surface-Median,175' Platform	Each	$285,000	0	$0	30 years	
13	BART Subway Station	Each	N/A	0	$0	30 years	
14	LRT Subway Station	Each	$15,000,000	4	$60,000,000	30 years	Ped. connection add 1 station
15	LRT Elevated Station	Each	$2,000,000	3	$6,000,000	30 years	
16	Streetscape, Landscape, Etc.	Route Mile	$2,000,000	4.78	$9,560,000	20 years	
17	Civil & ROW Subtotal				$269,220,000		
18	Overhead Contact System	Track/Lane Mile	$500,000	13.3	$6,650,000	30 years	
19	Substation - LRT (Land not included)	Each	$1,000,000	0	$0	30 years	
20	Substation - Trolley Bus (Land not included)	Each	$800,000	2	$1,600,000	30 years	
21	Traction Power System	Route Mile	$750,000	7.4	$5,550,000	30 years	
22	Communications	Platform	$10,000	19	$190,000	30 years	
23	Street Lighting	Route Mile	$150,000	5.35	$802,500	30 years	
24	Block Signals/Power Switches	Route Mile	$750,000	1	$750,000	30 years	
25	Traffic Signal & Pre-empts	Intersection	$50,000	40	$2,000,000	30 years	
26	Fare Collection/ Vending Machine	Per Platform	$50,000	38	$1,900,000	30 years	
27	System Support Subtotal				$19,442,500		
28	SUBTOTAL				$288,662,500		
	Transit Vehicles						
29	LRV	Each	$2,700,000		$0	25 years	
30	Rapid Transit	Each	N/A		$0	25 years	
31	Articulated Trolley Bus	Each	$675,000	53	$35,775,000	18 years	Peak need + 15% spares
32	Dual Mode Bus	Each	$725,000		$0	15 years	
33	Vehicle Subtotal				$35,775,000		
34	Engineering & Administration Costs	%Other Costs	0.25		$72,165,625	30 years	25% of item 28
	Contingencies						
35	Civil & ROW	% Costs	0.3		$80,766,000	30 years	30% of item 17
36	System Support	% Costs	0.2		$3,888,500	30 years	20% of item 27
37	Vehicles	% Costs	0.1		$3,577,500	varies	10% of item 33
38	TOTAL				$484,835,000		

Cost estimates are in 1994 dollars.
Alternative costs assume a shallow crossing at Market. For a deep tunnel add an additional $100 million to the cost.

(4/95)

Table 5F

Geary Corridor Transit Study Alternative Unit Prices

ALTERNATIVE 4

	Item	Unit	Price	Alternative 4 All Surface LRT Tranist Mall btwn Kearny & Mason Quantity	Subtotal	Economic Life	Remarks
	LIGHT RAIL TRANSIT OPTIONS						
1	Governmental Utility Relocation	Route Mile	$3,000,000	6.41	$19,230,000	30 years	
2	Street Reconstruction- w/LRT in Street	Route Mile	$3,500,000	6.41	$22,435,000	20 years	
3	Traffic Routing	Route Mile	$500,000	6.41	$3,205,000		
4	LRT Track & Roadbed- Embedded Track in Pavement	Track Mile	$1,600,000	10.79	$17,264,000	30 years	
5	LRT Track & Roadbed- Direct Fixation W/Plain Concrete	Track Mile	$1,400,000	2.23	$3,122,000	30 years	
6	LRT Special Work - Crossover	Each	$250,000	3	$750,000	30 years	
7	Structures - Viaduct	Route Foot	$4,000	5400	$21,600,000	30 years	
8	Structures - Standard Tunnel	Track Foot	$11,000	0	$0	30 years	
9	Structures - Tunnels in Soft Soil	Track Foot	$15,000	0	$0	30 years	
10	Structures - Portals	Each	$5,700,000	0	$0	30 years	
11	Boarding Islands - Surface-Median,	Each	$85,000	5	$425,000	30 years	
12	LRT Stations - Surface-Median, 175' Platform	Each	$285,000	13	$3,705,000	30 years	
13	BART Subway Station	Each	N/A	0	$0	30 years	
14	LRT Subway Station	Each	$15,000,000	0	$0	30 years	
15	LRT Elevated Station	Each	$2,000,000	3	$6,000,000	30 years	
16	Tranisit Mall Treatment	Route Mile	$5,000,000	0.76	$3,800,000	20 years	
17	Streetscape, Landscape, Etc.	Route Mile	$2,000,000	6.41	$12,820,000	20 years	
18	Civil & ROW Subtotal				$114,356,000		
19	Overhead Contact System	Track/Lane Mile	$500,000	12.82	$6,410,000	30 years	
20	Substation - LRT (Land not included)	Each	$1,000,000	0	$0	30 years	
21	Substation - Trolley Bus (Land not included)	Each	$800,000	2	$1,600,000	30 years	
22	Traction Power System	Route Mile	$750,000	6.41	$4,807,500	30 years	
23	Communications	Platform	$10,000	22	$220,000	30 years	
24	Street Lighting	Route Mile	$150,000	6.41	$961,500	30 years	
25	Block Signals/Power Switches	Route Mile	$750,000	0	$0	30 years	
26	Traffic Signal & Pre-empts	Intersection	$50,000	40	$2,000,000	30 years	
27	Fare Collection/ Vending Machines	Per Platform	$50,000	38	$1,900,000	30 years	Allow 2 per station
28	System Support Subtotal				$17,899,000		
29	SUBTOTAL				$132,255,000		
	Transit Vehicles						
30	LRV	Each	$2,700,000	44	$118,800,000	25 years	Peak demand + 15%
31	Rapid Transit	Each	N/A		$0	25 years	
32	Articulated Trolley Bus	Each	$675,000		$0	18 years	
33	Dual Mode Bus	Each	$725,000		$0	15 years	
34	Vehicle Subtotal				$118,800,000		
35	Engineering & Administration Costs	%Other Costs	0.25		$33,063,750	30 years	25% of item 29
	Contingencies						
36	Civil & ROW	% Costs	0.3		$34,306,800	30 years	30% of item 18
37	System Support	% Costs	0.2		$3,579,800	30 years	20% of item 28
38	Vehicles	% Costs	0.1		$11,880,000	varies	10% of item 34
39	TOTAL				$333,885,000		

Cost estimates are in 1994 dollars

(4/95)

Table 5G

Geary Corridor

Comparison of Operating Costs

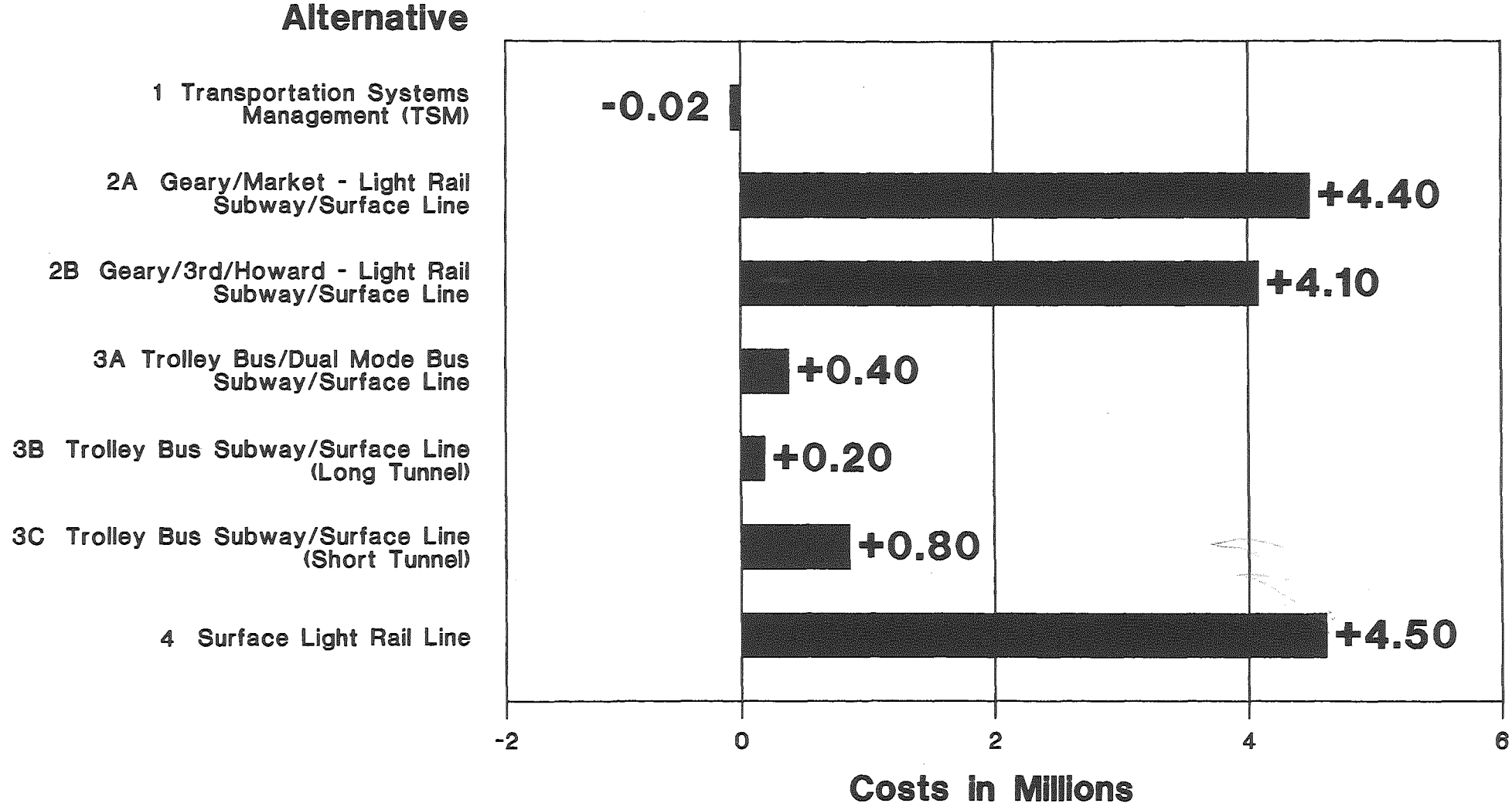


Figure 11

ESTIMATED ANNUAL O&M COSTS FOR GEARY CORRIDOR OPERATIONS

MODE	UNIT COST	UNIT	NO-BUILD UNITS	NO-BUILD COST	TSM UNITS	TSM COST	ALT. 2A UNITS	ALT. 2A COST	ALT. 2B UNITS	ALT. 2B COST	ALT. 3A UNITS	ALT. 3A COST	ALT. 3B UNITS	ALT. 3B COST	ALT. 3C UNITS	ALT. 3C COST	ALT. 4 UNITS	ALT. 4 COST	Source
MOTOR BUS:																			
Peak Buses	$58,862	Bus	2	$117,724	(2)	($117,724)	(45)	($2,648,781)	(45)	($2,648,781)	(48)	($2,825,366)	(45)	($2,648,781)	(45)	($2,648,781)	(45)	($2,648,781)	Tables A,B,8
Ann. Rev. Bus-Hours	$40.59	Bus-Hr.	5,720	$232,175	2,669	$108,335	(118,386)	($4,805,288)	(118,386)	($4,805,288)	(133,307)	($5,410,931)	(118,386)	($4,805,288)	(118,386)	($4,805,288)	(118,386)	($4,805,288)	Tables C,14
Ann. Rev. Bus-Miles	$2.90	Bus-Mi.	43,236	$125,384	61,739	$179,043	(938,805)	($2,722,535)	(938,805)	($2,722,535)	(1,000,492)	($2,901,427)	(938,805)	($2,722,535)	(947,678)	($2,748,266)	(947,678)	($2,748,266)	Tables C,14
Total Diesel Bus Cost:				$475,283		$169,654		($10,176,603)		($10,176,603)		($11,137,724)		($10,176,603)		($10,202,334)		($10,202,334)	
ETB/DUAL MODE BUSES:																			
Peak Buses	$47,435	Bus	N/A	$0	N/A	$0	N/A	$0	N/A	$0	49	$2,324,319	43	$2,039,709	46	$2,182,014	N/A	$0	Table Z
Ann. Rev. Bus-Hours	$42.66	Bus-Hr.	N/A	$0	N/A	$0	N/A	$0	N/A	$0	133,880	$5,711,321	111,695	$4,764,909	119,677	$5,105,421	N/A	$0	Table 14
Ann. Rev. Bus-Miles	$2.36	Bus-Mi.	N/A	$0	N/A	$0	N/A	$0	N/A	$0	1,140,347	$2,691,219	1,289,051	$3,042,160	1,222,610	$2,885,360	N/A	$0	Table 14
Total ETB/DM Bus Cost:				$0		$0		$0		$0		$10,726,859		$9,846,778		$10,172,795		$0	
LRT:																			
Peak Cars	$88,835	LRVs	N/A	$0	N/A	$0	36	$3,198,068	32	$2,842,727	N/A	$0	N/A	$0	N/A	$0	38	$3,375,739	Table Z
Ann. Rev. Car-Hours	$65.86	Car-Hr.	N/A	$0	N/A	$0	106,801	$7,033,920	96,839	$6,377,844	N/A	$0	N/A	$0	N/A	$0	117,145	$7,715,195	Tables 4,14
Ann. Rev. Car-Miles	$5.33	Car-Mi.	N/A	$0	N/A	$0	1,125,576	$5,999,320	1,182,946	$6,305,102	N/A	$0	N/A	$0	N/A	$0	1,060,863	$5,654,400	Table 14
Subway Stations (4)	$367,436	Sub. Sta.	N/A	$0	N/A	$0	4	$1,469,744	6	$2,204,617	N/A	$0	N/A	$0	N/A	$0	0	$0	Def. of Alt.
Route Miles (4)	$113,208	Rt. Mi.	N/A	$0	N/A	$0	6.4	$724,532	6.6	$747,174	N/A	$0	N/A	$0	N/A	$0	6.4	$724,532	Table 1
Total LRT Cost:				$0		$0		$18,425,585		$18,477,464		$0		$0		$0		$17,469,866	
ADJUSTMENTS:																			
Proof of Payment																			
1 Operator/Train (Credit)	($42.23)	Car-Hr.	N/A	$0	N/A	$0	45,004	($1,900,370)	41,073	($1,734,365)	N/A	$0	N/A	$0	N/A	$0	49,127	($2,074,453)	Table 4
Fare Inspection	$1,500,000	System	NO	$0	NO	$0	YES	$1,500,000	YES	$1,500,000	NO	$0	YES	$1,500,000	YES	$1,500,000	YES	$1,500,000	MUNI (5)
Subway Stations																			
Station Agents (Credit)	($232,435)	Sub. Sta.	N/A	$0	N/A	$0	4	($929,740)	6	($1,394,610)	(No credit due)		(No credit due)		(No credit due)		N/A	$0	Def. of Alt.
Maintenance, Utilities	$135,000	Sub. Sta.	N/A	$0	N/A	$0	(Included in LRT cost)		(Included in LRT cost)		5	$675,000	5	$675,000	3	$405,000	N/A	$0	(3)
Security & Monitoring	$232,437	Agent	N/A	$0	N/A	$0	3	$697,311	4	$929,748	3	$697,311	3	$697,311	2	$464,874	N/A	$0	MUNI (6)
Vehicle Maintenance																			
LRT (25% Credit)	($1.07)	Car-Mi.	N/A	$0	N/A	$0	1,125,576	($1,207,180)	1,182,946	($1,268,710)	N/A	$0	N/A	$0	N/A	$0	1,060,863	($1,137,776)	MUNI (7)
Dual Mode Fuel	$0.02	Bus-Mi.	N/A	$0	N/A	$0	N/A	$0	N/A	$0	432,225	$10,451	N/A	$0	N/A	$0	N/A	$0	Table 10
Dual Mode Veh. Maint.	$0.14	Bus-Mi.	N/A	$0	N/A	$0	N/A	$0	N/A	$0	432,225	$60,010	N/A	$0	N/A	$0	N/A	$0	Table 10
O&M Cost Savings for Parallel Bus Routes (8)				N/A		($193,479)		($1,994,327)		($2,247,338)		($654,854)		($2,306,871)		($1,562,719)		($1,101,345)	MUNI (8)
Total Adjustments:				$0		($193,479)		($3,834,306)		($4,215,275)		$787,918		$565,440		$807,155		($2,813,573)	
COST RELATIVE TO EXISTING CORRIDOR SERVICE:				$475,283		($23,825)		$4,414,676		$4,085,586		$377,054		$235,615		$777,615		$4,453,958	
INCREMENTAL COST RELATIVE TO TSM:				NA		NA		$4,438,501		$4,109,411		$400,878		$259,440		$801,440		$4,477,783	

NOTES:

(1) Operating statistics are based on year 2010 projected ridership and are relative to existing Geary Corridor service (hours and miles adjusted for actual vs. scheduled service).
(2) Operating statistics prepared by Nelson-Nygaard (operating statistics, January 17, 1995; equipment demand, January 24, 1994).
(3) Unit costs presented in memo from John Mason to Jerry Cauthen, November 1, 1994.
(4) Revised LRT station unit cost includes station utilities, maintenance and station agent costs (memo from Dan Rosen to Sue Olive, Sept. 1, 1994). LRT route-miles (miles from terminal to terminal) unit cost was revised accordingly.
(5) Proof-of-payment budget for Geary Corridor estimated by MUNI (memo from Sue Olive to Jerry Cauthen, October 12, 1994). Assumes citation revenues equal fare evasion loss.
(6) Subway station security and monitoring based on staffing levels specified by MUNI (memo from Jerry Cauthen to Sue Olive, Oct. 20, 1994) and average wages and fringe benefits (memo from Dan Rosen to Sue Olive, Sept. 1, 1994).
(7) Light rail vehicle maintenance cost adjustment based on 25% cost reduction with new LRV fleet, per MUNI's Short Range Transit Plan Capital Improvement Program (memo from Sue Olive to Jerry Cauthen, Oct. 12, 1994).
(8) O&M cost savings for parallel bus routes provided by MUNI (FAX from Sue Olive, November 14, 1994).
(9) Costs estimated in 1993 dollars.

Prepared by: Manuel Padron & Associates

Revised
13-Mar-95

Table 6

GEARY CORRIDOR SYSTEMS PLANNING STUDY
COST EFFECTIVENESS INDEX (CEI) CALCULATIONS

03/28/95

PBQ&D

ALT.	A NEW RIDERS (1)	B ANNUALIZED CAPITAL COSTS (1)	C ANNUAL O&M COSTS (1)	D VALUE OF TRAVEL TIME SAVINGS (1)(2)	E USER BENEFIT HOURS	(B+C-D)/A NEW RIDER CEI INDEX	(B+C)/E USER BENEFIT CEI INDEX
TSM	--	--	--	--	--	--	--
2A	663,600	$49,820,124	$4,438,501	$5,881,708	1,509,848	$72.90	$35.94
2B	884,800	$69,522,341	$4,109,411	$7,534,388	1,897,264	$74.70	$38.81
3A	316,000	$45,140,275	$400,878	$2,986,200	836,136	$134.67	$54.47
3B	884,800	$52,502,400	$259,440	$7,373,544	2,147,852	$51.30	$24.56
3C	632,000	$36,258,121	$801,440	$5,338,504	1,557,880	$50.19	$23.79
4	347,600	$24,122,432	$4,477,783	$3,402,056	804,220	$72.49	$35.56

ANNUALIZATION FACTOR = 316

Source: Parsons Brinckerhoff, January 1995

(1) Change from the TSM Alternative

(2) Hours saved times $4.80 for work trips and $2.40 for non-work trips

Table 7

D. Land Use/Economic Effects

Major planning policy issues within the Geary Corridor have been identified and analyzed as they apply to the alternatives evaluated in the Geary Transit Study. During the development of the seven candidate alternatives, the Study Team considered a number of existing plans affecting the Geary Corridor including: the Regional Transportation Plan (RTP) for the nine-county Bay Area, developed by the Metropolitan Transportation Commission (MTC); the San Francisco Master Plan (specifically, the Transportation Element, Commerce and Industry Element, Residence Element, and Urban Design Element); and institutional master plans for the governmental centers, educational institutions, health facilities, and historic and recreational districts, located wholly or partly within the Corridor. The broad zoning land use patterns of the Geary Corridor, ranging from downtown office uses to residential mixed and public uses, were also considered.

Also considered were possible economic impacts of alternative transit improvements and strategies to address unwanted growth (if any) that may be created as the result of such projects. It was determined that the transit alternatives examined as part of this study would not, in and of themselves, tend to induce growth. However, it should be kept in mind that some development can be expected--independent of proposed transit improvements--because of development projects already in the pipeline and zoning ordinances that permit a certain level of growth. Estimates of likely growth were projected for the year 2010 as input to the patronage forecast.

Development potential for general areas and specific sites within the Geary Corridor has previously been established, analyzed and published. The Financial District and the Union Square/Civic Center areas are major activity centers within the City and region. However, because of significant build out, in these areas, the potential for vitalization and development is limited to infill and adaptive reuse. The Mixed Use Residential/Neighborhood Commercial area, generally from Van Ness to Sixth Avenue, is an area of the Corridor which has the most potential for site development and vitalization as identified in institutional master plans, Redevelopment Agency planning areas, and field investigations. The character and uses of the Residential/Neighborhood Commercial area west of Sixth Avenue, dictate low density uses. The potential for future development in this area is very limited, expected to be infill projects conforming to existing development and character only. Existing and currently proposed planning ordinances will continue to preserve low density uses.

There are some planning issues identified which are common to all alternatives. Other issues are unique to specific alternatives, while others are pertinent to a particular subdistrict or neighborhood. None of the alternatives raises a "fatal flaw" from a planning perspective. The exclusive transit right-of-way along Geary raises issues related to automobile travel lane reductions, reconfiguration of on-street parking (with possible changes in parking supply), changes in pedestrian spaces, and impacts on urban design. The location and

distance between transit stops also raises issues respective to equitable access, efficient travel times, and the potential for dislocating on-street parking.

As mentioned previously, the proposed transit improvements would not tend to promote economic development in and of themselves. However, the alternatives could provide improved access to areas where development opportunities are acceptable to adjacent communities, such as the Western Addition. In these areas fixed guideway improvements (such as electric trolley bus or light rail alternatives) could act as a stimulus to growth, provided that the area were zoned for additional development and market factors were favorable.

A planning issue throughout the Richmond, for residents and businesses, is conservation of the existing character of development. None of the alternatives would have direct impact which would induce development beyond the current level, and existing or currently proposed zoning would generally preclude higher density development.

Alternatives 2A, 2B, 3B and 3C would tend to support neighborhood planning and policy implementation in the areas of regional connectivity, urban design, and relative accessibility. However, these alternatives would affect surface street operations and capacity on Geary--impacts that will need to be defined more specifically in subsequent studies.

Alternative 1 would not adequately address mobility concerns in the Geary Corridor and would not promote a significant mode shift from automobile to transit. The western portion of the study area could be adversely affected due to congestion associated with the status quo (Alternative 1). With the implementation of Alternative 3C, there may also be adverse land use impacts associated with an exclusive right-of-way operation between Gough and Taylor.

The electric trolley and dual mode mixed flow operation west of Laguna in Alternative 3A would present fewer changes than Alternative 2A, 2B, 3B or 3C, and as such would have fewer impacts on neighborhood compatibility or changes in transit operations. For example, most existing transit stops and transfer points would still be served.

Alternative 4 (All Surface Light Rail) would create traffic impacts and urban design issues that would need to be addressed. This option would also feature median operations with associated traffic impacts.

For additional information about the Land Use/Economic Effects of the Geary Corridor Transportation Alternatives see Working Paper #7.

E. Environmental Effects

Based on the preliminary environmental review of potential environmental impacts of each of the seven alternatives, it was determined that several have the potential for adverse environmental impact. Of primary concern are land use/physical changes; visual impacts; socioeconomic effects;

transportation/circulation changes; geological conditions; exposure of hazardous substances and potential interference with emergency response; and impacts on landmark, historic, and architecturally significant buildings.

Long term impacts could include possible reduction of traffic lanes and some minimal reduction in on-street parking, changes in parking patterns, possible increase in potential conflicts between transit vehicles, motorists, bicyclists, and pedestrians where stations, stops, viaducts, and portals are proposed, and visual impacts of viaducts, subway portals and overhead wiring.

Temporary impacts of construction for any of the "build" alternatives would be more diverse and extensive in all categories mentioned in the preceding paragraph, as well as affecting noise levels and air quality. Mitigation measures have been identified for most of the impacts identified.

For further information regarding environmental effects and mitigation measures, see Appendix F.

F. Funding

It is probable that some level of federal capital funding will be available to the Geary Corridor alternatives, however the level of funding will be less than the 80/20 federal commitment often provided in the past and will be dependent upon:

- reauthorization levels of ISTEA;
- the region's ability to provide appropriate operating and maintenance funds;
- level of local matching revenues; and
- national and local competition for limited rail and bus capital funds.

The level of competition for federal rail monies is extremely high, with a long list of national projects well beyond the initial systems planning phases. In addition, the Bay Area currently has three rail projects pending, with significant earmarkings: the Colma Extension, BART to the Airport, and the Tasman Corridor. Even with the current Congressional efforts to deobligate the level of funding for these previous commitments, competition for funding additional rail corridors with federal funds will be high both locally and nationally. If, for example, one or more of the Bay Area's currently earmarked rail projects was not pursued due to environmental, policy or local funding source problems, other corridors, such as Geary, would have a higher probability of federal funding.

Given the patronage forecasts developed for this study, currently approved federal evaluation criteria for cost per new rider do not compare favorably with competing local and national projects. However, comparisons of time lost and overall benefits provided to existing and new riders provide the Corridor alternatives with more competitive rankings. More detailed patronage forecasting techniques and the application of new FTA approved evaluational

criteria in a Major Metropolitan Transportation Investment Study (MIS) could more definitively address these issues.

In light of the points above, and the current status of the City's and MUNI's operating budgets, the maximum federal participation that is assumed for this project is 50% federal funding for rail, 75% federal funding for bus improvements, and 80% federal funding for bus vehicles.

The projection of available State revenues for transit corridor investments is extremely speculative at this time. Given existing and projected State budget shortfalls, an optimistic assumption for future contributions to rail corridor projects in major California cities is assumed in this report at 15% of total costs.

MUNI and the City of San Francisco currently do not have access to operating revenues sufficient to sustain existing operations, or to adequately fund deferred maintenance and vehicle replacements. Significant expansions to MUNI's operating budget will require the implementation of an additional revenue source both to accommodate operating costs associated with the Geary Corridor alternatives and to fund the local match requirements of the project.

Sources of revenue that might be used for operating and capital matching purposes include the following options:

- regional sales tax on fuel;
- fare increases;
- parking taxes;
- revenue bonds;
- transit impact fees;
- bridge tolls;
- lease financing; and
- expansion/extension of the 1/2 cent sales tax.

Considering these assumptions, the following Tables 8 and 9A-G describe possible funding approaches that could be used for the different alternatives. It should be noted that the range of new funding revenues required to support these alternatives is between $20 - $255 million. Further, the new operating revenues required for the alternatives thereby significantly impacting the City's ability to finance upwards of $255 million capital, is between $236,000 and $4.45 million annually.

Summary Geary Corridor Financial Information

Project Elements	Alternatives 1	2A	2B	3A	3B	3C	4
Annual Operating Costs	($24,000)	$ 4,400,000	$ 4,000,000	$ 377,000	$ 236,000	$ 778,000	$ 4,500,000
Capital Costs							
Civil/ROW Subtotal	-	$ 323,865,000	$ 491,199,000	$ 341,102,000	$ 401,170,000	$ 269,220,000	$ 114,356,000
System Support Subtotal	$ 2,450,000	$ 18,859,000	$ 19,673,000	$ 15,679,500	$ 19,149,500	$ 19,442,500	$ 17,899,000
Vehicle Subtotal	$ 26,800,000	$ 113,400,000	$ 99,900,000	$ 39,975,000	$ 33,750,000	$ 35,775,000	$ 118,800,000
Eng/Admin/Contin	$ 3,783,000	$ 197,952,000	$ 289,002,000	$ 198,532,500	$ 232,635,500	$ 160,397,500	$ 82,830,000
Total Capital Costs	$ 33,033,000	$ 654,076,000	$ 899,774,000	$ 595,289,000	$ 686,705,000	$ 484,835,000	$ 333,885,000
Ridership Change From TSM	-	663,600	884,800	316,000	884,800	632,000	347,600
New Rider CEI Index	-	$ 74.08	$ 75.59	$ 140.10	$ 53.26	$ 52.92	$ 74.75
User Benefit CEI Index	-	$ 36.45	$ 39.22	$ 56.52	$ 25.37	$ 24.90	$ 36.54

Alternative Definitions

Alternative 1: TSM
Alternative 2A: LRV, Subway, Laguna to Union Square
Alternative 2B: LRV, Subway, Howard to Beale
Alternative 3A: Electric Trolley Bus, Mixed Flow West of Laguna
Alternative 3B: Electric Trolley Bus, Median West of Laguna
Alternative 3B: Electric Trolley Bus, Median West of Taylor
Alternative 4: All Surface LRT

Table 8

Alternative 1: Transportation System Management (TSM)

Potential Funding Sources	Amounts	Share
Federal Sources		
Section 3 New Start		
Section 3 Bus Capital	$ 25,086,400	76%
State Sources		
TCI/FCR/New Source		
Regional Sources		
Sales Tax on Fuel/New Source*		
Local Sources		
Existing Sales Tax	$ 7,946,600	24%
Financing/New Sources**		
Total	$ 33,033,000	100%

* In 1994 $.

**May be intrchangeable.

Table 9A

Alternative 2A: Geary/Market LRT Subway and Surface Line

Potential Funding Sources	Amounts*	Share
Federal Sources		
Section 3 New Start	$ 327,038,000	50%
Section 3 Bus Capital		
State Sources		
TCI/FCR/New Source	$ 65,407,600	10%
Regional Sources		
Sales Tax on Fuel/New Source**	$ 32,703,800	5%
Local Sources		
Existing Sales Tax	$ 100,000,000	15%
New Sales Tax**		
Financing	$ 128,926,600	20%
Total	$ 654,076,000	100%

* In 1994 $.
**May be intrchangeable.

Table 9B

Alternative2B: Geary/Third Street/Howard LRT Subway/Surface Line

Potential Funding Sources	Amounts*	Share
Federal Sources		
Section 3 New Start	$ 449,887,000	50%
Section 3 Bus Capital		
State Sources		
TCI/FCR/New Source	$ 89,977,400	10%
Regional Sources		
Sales Tax on Fuel/New Source**	$ 44,988,700	5%
Local Sources		
Existing Sales Tax	$ 100,000,000	11%
Financing/New Sources**	$ 214,920,900	24%
Annual Operating Requirements	$ 4,100,000	
Total	$ 899,774,000	100%

* In 1994 $.
** May be interchangeable.

Table 9C

Alternative 3A: Electric Trolley/Dual Mode Bus Subway/Surface Line

Potential Funding Sources	Amounts*	Share
Federal Sources		
Section 3 New Start		
Section 3 Bus Capital	$ 474,232,500	80%
State Sources		
TCI/FCR/New Source	21,056,500	
Regional Sources		
Sales Tax on Fuel/New Source**		
Local Sources		
Existing Sales Tax	$ 100,000,000	17%
Financing/New Sources**		
Total	$ 595,289,000	100%

* In 1994 $.

**May be interchangeable.

Table 9D

Alternative 3B: Electric Trolley Bus Subway/Surface Line

Potential Funding Sources	Amounts*	Share
Federal Sources		
Section 3 New Start		
Section 3 Bus Capital	$ 25,086,400	76%
State Sources		
TCI/FCR/New Source		
Regional Sources		
Sales Tax on Fuel/New Source		
Local Sources		
Existing Sales Tax	$ 7,946,600	24%
Financing/New Sources		
Total	$ 33,033,000	100%

* In 1994 $.

** May be interchangeable.

Table 9E

Alternative 3C: Electric Trolley Bus Subway/Surface Line

Potential Funding Sources	Amounts*	Share
Federal Sources		
Section 3 New Start		
Section 3 Bus Capital	$ 365,415,000	75%
State Sources		
TCI/FCR/New Source	$ 50,000,000	10%
Regional Sources		
Sales Tax on Fuel/New Source		
Local Sources		
Existing Sales Tax	$ 69,420,000	14%
Financing/New Sources**		
Total	$ 484,835,000	100%

* In 1994 $.

**May be interchangeable.

Table 9F

Alternative 4: Surface LRT Line

Potential Funding Sources	Amounts*	Share
Federal Sources		
Section 3 New Start	$ 166,942,500	50%
Section 3 Bus Capital		
State Sources		
TCI/FCR/New Source	$ 33,000,000	10%
Regional Sources		
Sales Tax on Fuel/New Source**		
Local Sources		
Existing Sales Tax	$ 100,000,000	30%
Financing/New Sources**	$ 33,942,500	10%
Total	$ 333,885,000	100%

* In 1994 $.

** May be interchangeable.

Table 9G

G. Comparison of Alternatives

Each of the seven Geary Corridor alternatives selected for additional evaluation has unique advantages and disadvantages.

The trip time, ridership and cost results of the seven alternatives are summarized in Table 10. The pros and cons are discussed briefly below:

The TSM Alternative. The TSM alternative has the advantage of being relatively inexpensive, with respect to both capital cost and operating and maintenance cost. On the other hand, it has the lowest average transit vehicle speed and consequently the highest trip times and lowest projected patronage of any of the seven alternatives.

In short, the TSM alternative, while it helps a little, leaves transit vehicles essentially in mixed flow traffic. The long term benefits to transit riders, and would be transit riders, is therefore quite limited under the TSM Alternative.

Alternative 2A. This alternative puts light rail vehicles in a median between 39th and Laguna, and in subway between Laguna and Market. From the point where the LRVs emerge from the subway at the foot of Geary and O'Farrell, the vehicles travel on existing Market Street surface tracks to the Transbay Terminal. Absent major steps to reduce mixed flow traffic on Lower Market Street, LRVs would travel relatively slowly for the easterly leg of their trips. Alternative 2A has the strong advantage of taking people directly into the heart of the financial district and, unless steps are taken to divert other traffic, the disadvantage of running on the surface of Market Street.

Because of the median operation and the subway under Geary and O'Farrell, Alternative 2A significantly reduces trips times and therefore projects a significant increase in patronage. Capital costs are high because of the subway. Operating and maintenance costs are high because of the relatively high cost of operating a light rail service.

Alternative 2B. This alternative incorporates the longest subway and the most subway stations. For this reason it is the most costly of all the alternatives. Operating costs are high because of the light rail operation, but slightly lower than that associated with Alternatives 2A and 4 because of the higher operating speeds achievable in subways.

Because of the slightly shorter trip times relative to Alternative 2A, Alternative 2B projects a slightly higher ridership than 2A.

Alternative 3A. Alternative 3A, since it features dual mode and electric trolley buses operating in mixed flow traffic until they reach the downtown subway at Laguna, has the longest trip times of any of the "build" alternatives and therefore the lowest projected ridership.

Because of reduced subway station costs, lower cost of buses (compared to light rail vehicles) and the absence of a median, Alternative 3A is cheaper than the other subway/surface alternatives (but more expensive than Alternative 4, the all-surface rail alternative). The operating and maintenance costs of

Alternative 3A (as well as those of Alternatives 3B and 3C) may be significantly lower than those of any of the light rail alternatives.

Alternative 3B. Alternative 3B is approximately $90 million more expensive than 3A, primarily because of the cost of the transit-only median and the viaducts at Fillmore and Presidio Avenue, off-set to some degree by the reduced number of buses required.

Trips times are lower than 3A because of the speeded up operation facilitated by the median; therefore projected patronage is higher.

Alternative 3C. Alternative 3C is significantly cheaper than 3B because of the reduced length of subway and because, under 3C, the surface travel between Laguna and Taylor precludes the need for subway stations at Van Ness and Leavenworth.

However, the delays caused by the surface travel between the east end of the median and the west end of the subway cause a significant increase in trip times relative to Alternative 3B; with corresponding reductions in projected ridership.

Alternative 4. Most of the trip time savings of the subway alternatives actually derive from the exclusive right-of-way operation west of Laguna - more so than for the relatively short subway. Alternative 4 retains these benefits, but because it is an all-surface line, the trip time for Alternative 4 is six minutes slower than the partial subway options. However, the capital cost to construct a surface line is up to half a billion dollars less than the partial subway light rail options 2A and 2B. Projected patronage is lower than the subway options because of slower travel speeds, but higher than Alternative 3A and the TSM mixed flow alternatives. Because of the slower speeds and therefore greater number of required LRVs, Alternative 4 has higher O&M costs than the other light rail alternatives.

As indicated above, the relative characteristics of the seven alternatives are summarized in Table 10.

Comparison of Geary Transit Study Alternatives

Characteristics	Existing (1995)	No Build (2010)	1 (TSM) (2010)	2A (2010)	2B (2010)	3A (2010)	3B (2010)	3C (2010)	4 (2010)
MODE	Diesel Bus	Diesel Bus	Diesel Bus	Light Rail	Light Rail	Trolley Bus	Trolley Bus	Trolley Bus	Light Rail
Subway Segment	None	None	None	Laguna to Union Square	Laguna to Howard/ Beale	Laguna to Howard/ Second	Laguna to Howard/ Second	Laguna to Howard/ Second	None
Median Operations	No	No	No	Yes	Yes	No	Yes	Yes	Yes
One-Way Route Miles	6.7 38L 6.7 38	6.7 38L 6.7 38	6.7 38L 6.7 38	6.4	6.6	6.4	6.4	6.4	6.4
One-Way Travel Time to Sansome/Market (minutes)	40.0 38L 49.0 38	40.0 38L 49.0 38	39.5 38L 47.2 38	28.6	29.1	41.0 ETB 35.8 DM	30.6	34.7	34.3
Headways (minutes)*									
Peak	3.16	2.98	2.91	6.00	5.82	2.73	2.29	2.47	6.60
Base	3.60	3.39	3.31	6.83	6.63	3.11	2.61	2.81	7.52
Equipment Demand (Peak)	25 38L 24 38	26 38L 25 38	24 38L 23 38	36	32	23 ETB 26 DM	43	46	38
Total Capital Cost (millions)***	N/A	$31.7	$33.0	$654.1	$899.8	$595.3	$686.7	$484.8	$333.9
Change in Net Annual Operating & Maintenance Cost (millions)****	N/A	+$0.25	-$.02	+$4.40	+$4.10	+$0.40	+$0.20	+$0.80	+$4.50
Patronage: Daily Boardings on Geary	57,700	61,200	62,700	76,900	79,300	66,800	79,700	73,900	69,900

*Combined 38 and 38L services.
**Combined electric trolley bus (ETB) and dual mode (DM) services.
***In 1994 dollars.
****In 1994 dollars, compared to existing.

Table 10

CONCLUSIONS AND RECOMENDATIONS

IV. CONCLUSIONS AND RECOMMENDATIONS

Based upon the results of the Geary Corridor System Planning Study as summarized in Section III above, and as an outgrowth of the ongoing Citywide Fixed Guideway Plan, we have the following conclusions and recommendations:

A. Need for Major Improvement of Geary Corridor Public Transit System. Because of:

- the very high public use of Geary Corridor buses despite the loss of time, reliability and comfort caused by their having to travel in mixed flow traffic lanes;

- the likelihood that the traffic and other adverse conditions which already make Geary Corridor bus travel a relatively frustrating and uncomfortable experience will worsen with time as the San Francisco Bay Region grows; and

- the preference of most of the people attending the 10 public meetings for a major investment which would result in a significant improvement in the reliability and general quality of Geary Corridor transit services

Recommendation No. 1: that subject to the availability of funds, the City move ahead with a major capital investment to improve the Geary Corridor public transit service and that this improvement include significant reduction in public transit trip times as well as significant improvement in public transit reliability and patron comfort.

B. Advancement into the Next Stage. As an outgrowth of comments received during the Public Participation Program, and based upon intensive screening by representatives of the San Francisco Transportation Authority, the City Departments of Parking and Traffic and City Planning, and MUNI as well as by representatives of the Bay Area Rapid Transit District and the Consultant team, the seven options described above were reduced in number and combined into the following four alternatives:

Alternative 1 - TSM

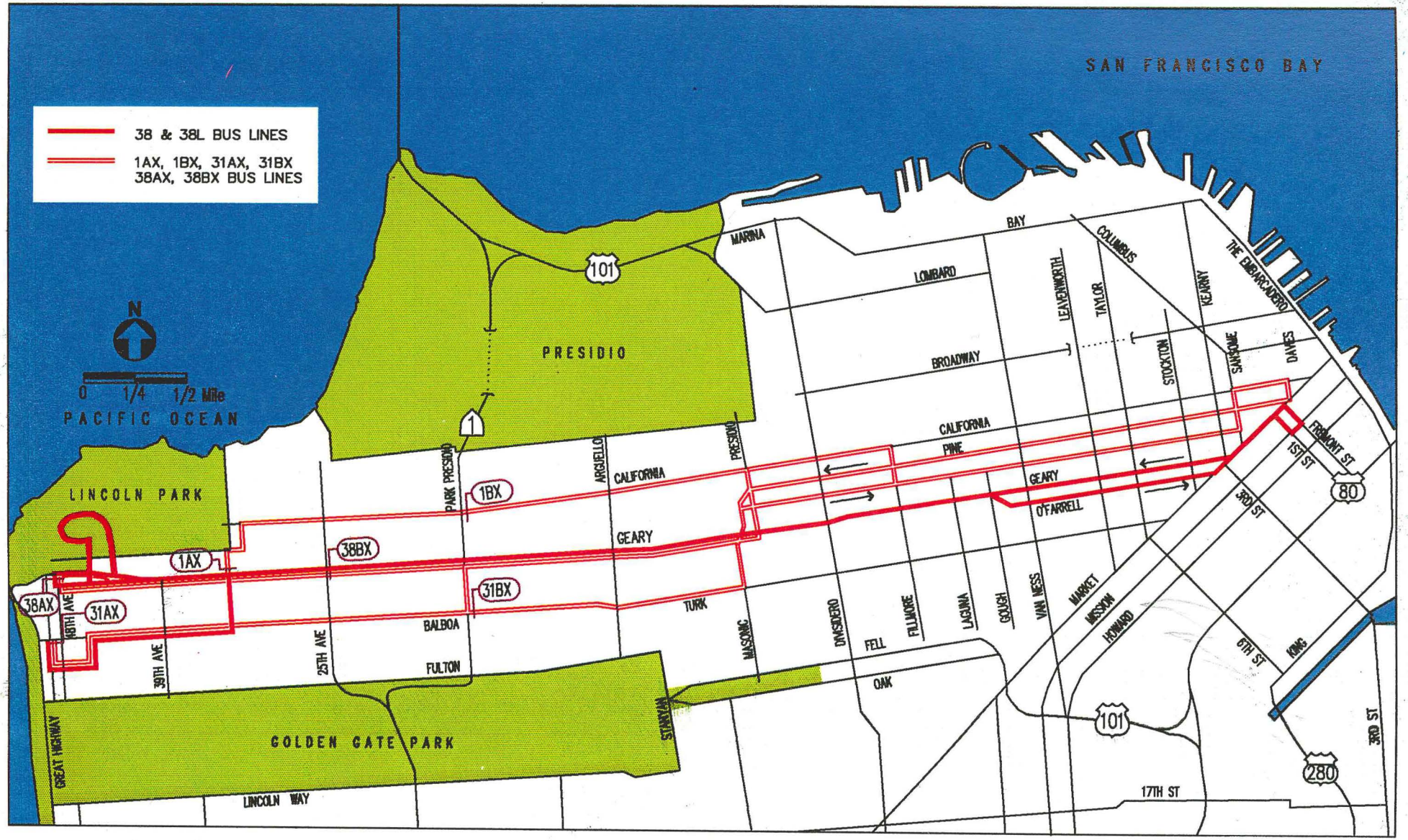


Figure 12A

MUNI GEARY TRANSIT STUDY

Alternative 2 - Partial Subway Light Rail
(Three Downtown Terminal Options)

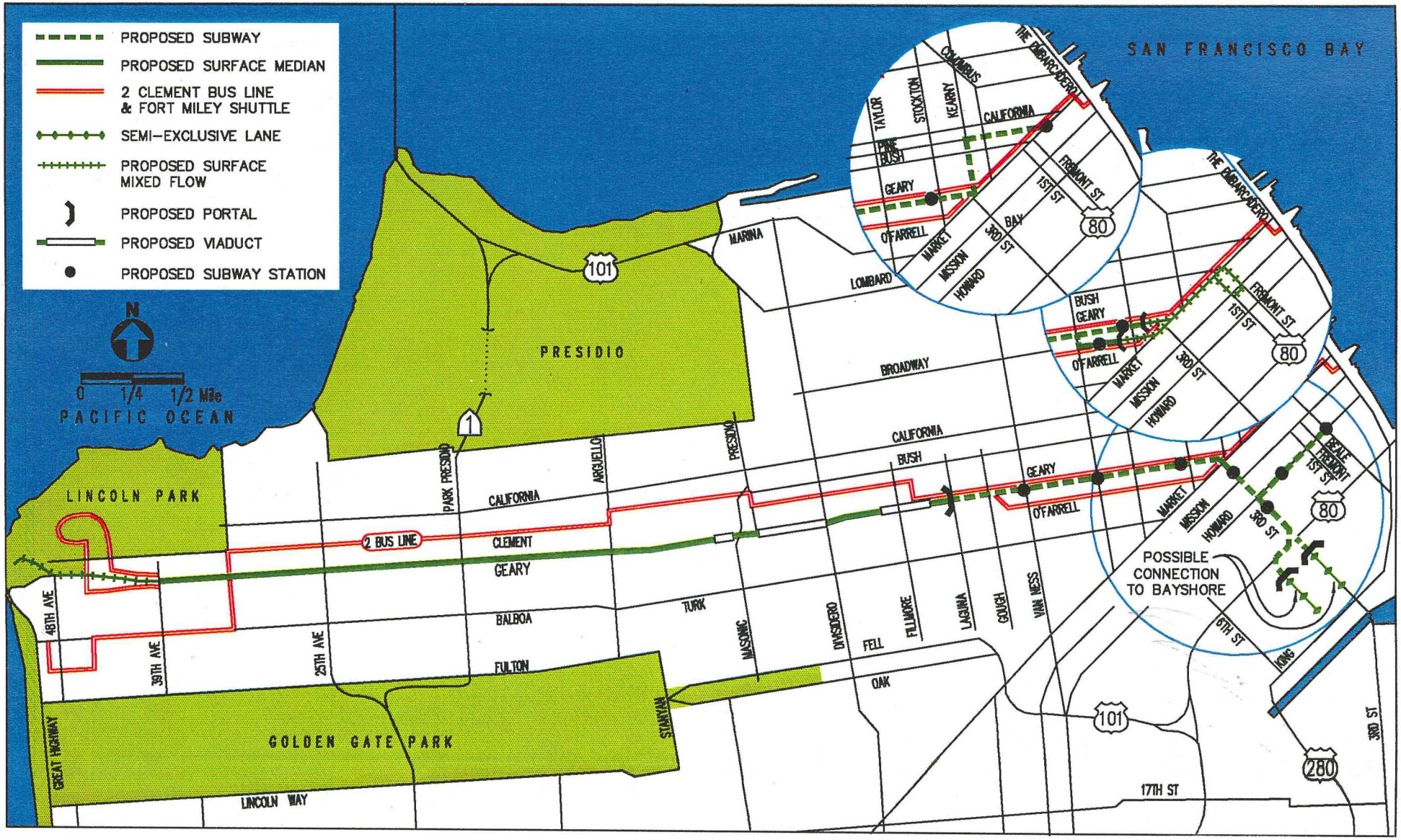


Figure 12B

MUNI GEARY TRANSIT STUDY

Alternative 3 - Electric Trolley Bus

(Median surface operation west of Laguna)

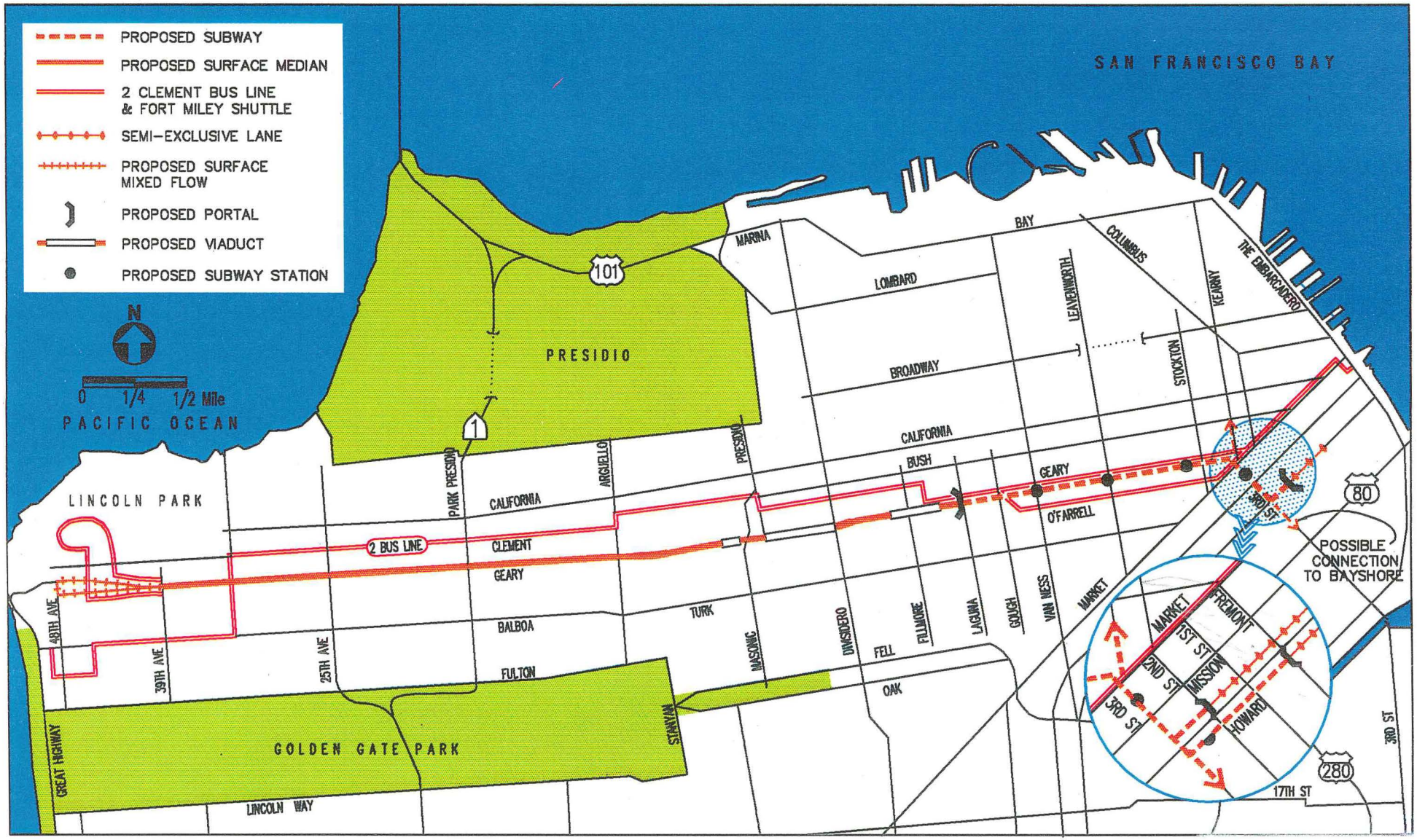


Figure 12C

MUNI GEARY TRANSIT STUDY

Alternative 4 - All Surface Light Rail

(Transit Mall between Mason & Kearny)

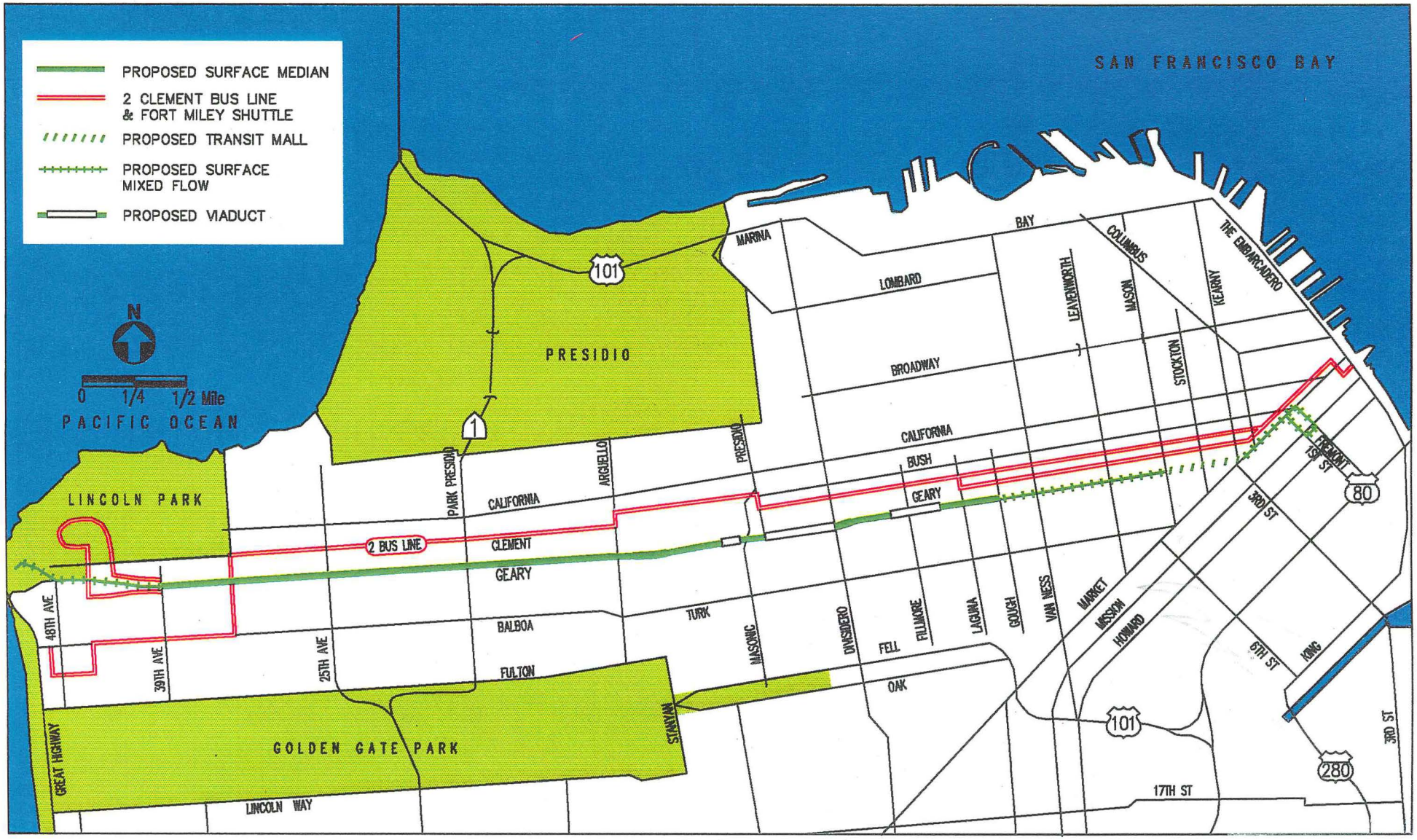
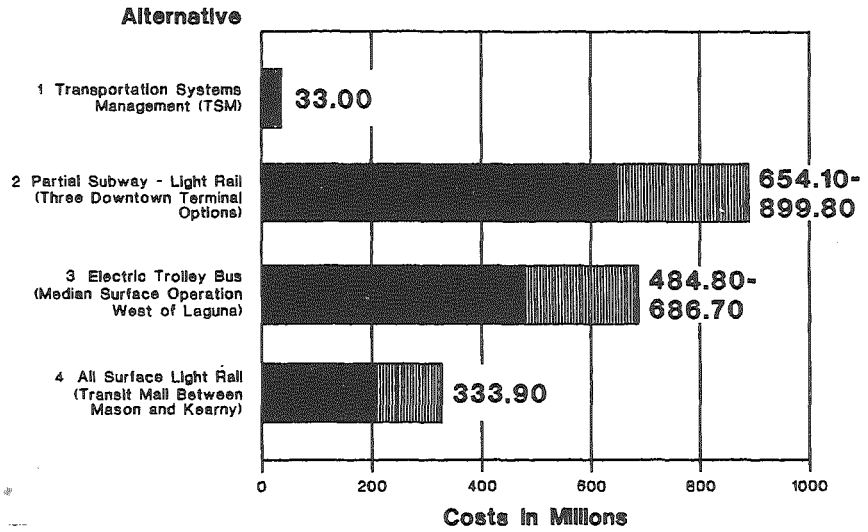


Figure 12D

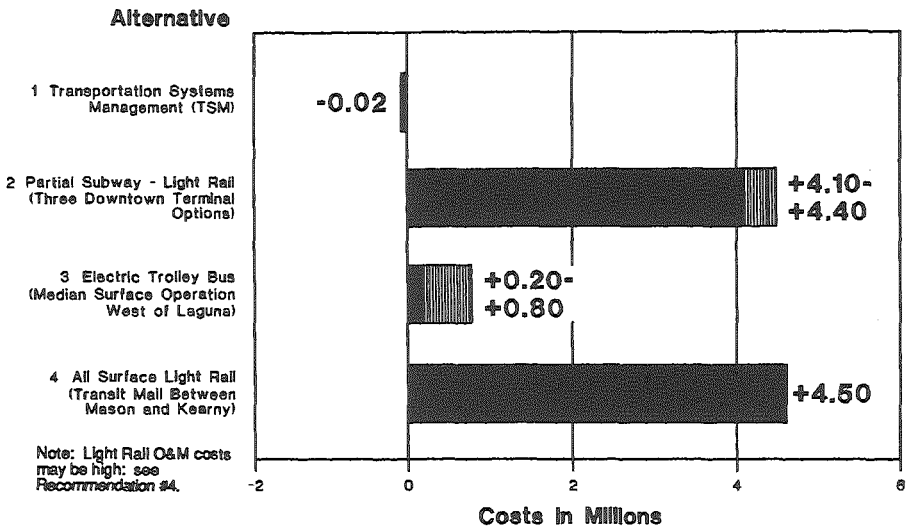
MUNI GEARY TRANSIT STUDY

Geary Corridor

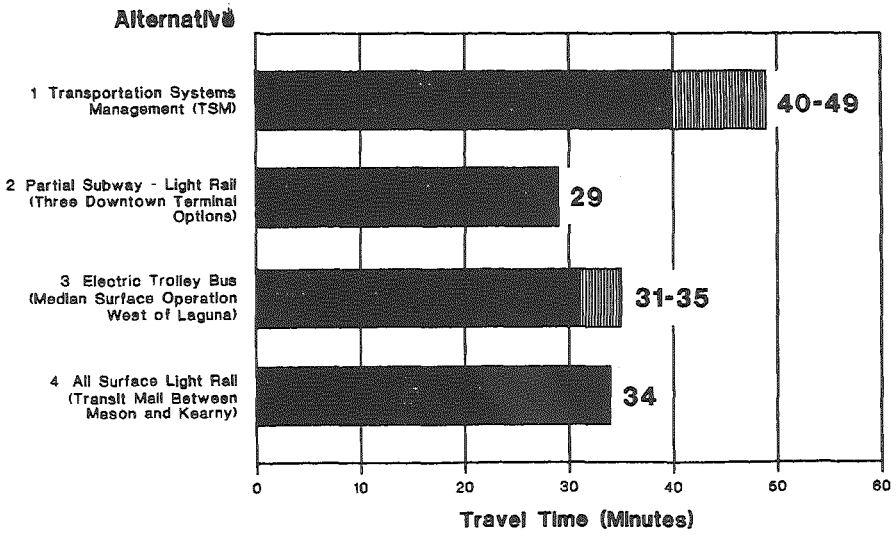
Comparison of Capital Costs



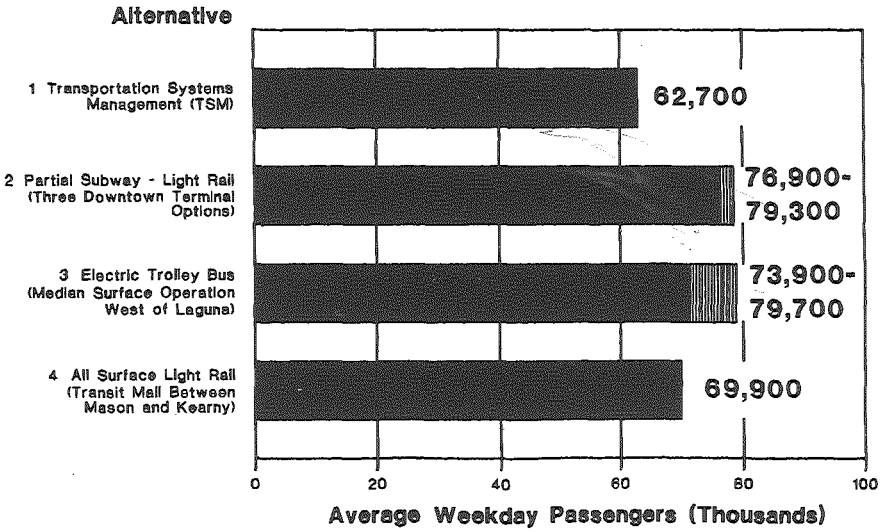
Comparison of Operating Costs



Comparison of Travel Times to Sansome and Market



Comparison of Daily Ridership - Year 2010



MUNI GEARY TRANSIT STUDY

Figure 13

Comparison of Recommended Geary Transit Study Alternatives

Characteristics	Existing (1995)	1 (TSM) (2010)	2 (2010)	3 (2010)	4 (2010)
MODE	Diesel Bus	Diesel Bus	Light Rail	Trolley Bus	Light Rail
Subway Segment	None	None	From Laguna to 3 downtown terminal options	From Laguna or Taylor to Howard/Second	None
Median Operations	No	No	Yes	Yes	Yes
One-Way Route Miles	6.7 38L 6.7 38	6.7 38L 6.7 38	6.4 to 6.6	6.4	6.4
One-Way Travel Time to Sansome/Market (minutes)	40.0 38L 49.0 38	39.5 38L 47.2 38	28.6 to 29.1	30.6 to 34.7	34.3
Headways (minutes)*					
Peak	3.16	2.91	5.82 to 6.00	2.29 to 2.47	6.60
Base	3.60	3.31	6.63 to 6.83	2.61 to 2.81	7.52
Equipment Demand (Peak)	25 38L 24 38	24 38L 23 38	32 to 36	43 to 46	38
Total Capital Cost (millions)***	N/A	$33.0	$654.1 to $899.8	$484.8 to $686.7	$333.9
Change in Net Annual Operating & Maintenance Cost (millions)****	N/A	-$.02	+$4.10 to +$4.40	+$0.20 to +$0.80	+$4.50
Patronage: Daily Boardings on Geary	57,700	62,700	76,900 to 79,300	73,900 to 79,700	69,900

*Combined 38 and 38L services.
**Combined electric trolley bus (ETB) and dual mode (DM) services.
***In 1994 dollars.
****In 1994 dollars, compared to existing.

Table 11

1. Alternative 1 TSM

This alternative consists of two variations; namely the No- Build Alternative and the Transportation Systems Management (TSM) Alternative.

Under a "no-build" alternative, nothing would be done other than to increase the level of existing bus service to keep up with increased patronage. Local policy makers usually want to see what the a no-build condition would cost to help them evaluate the feasibility of the more costly solutions.

Under a TSM alternative as defined in federal guidelines, the existing system would improved through relatively low cost means to render it as efficient and effective as possible. The federal government uses the TSM alternative rather than the no-build alternative as a standard against which to evaluate the feasibility of the more costly "build" alternatives. The federal government wants to see what can be done cheaply before they commit themselves to help pay for more expensive solutions.

There are many gradations of TSM improvement. Virtually anything that can be done to the existing bus service that would speed it up, make it more reliable or safer or more comfortable or easier to understand and use would qualify as a TSM improvement.

TSM improvements affecting the Geary bus lines could include any or all of the following:

- Pre-emption of Traffic Signals: would give transit vehicles priority over other vehicles at crossing points; (opportunities to improve service limited due to heavy cross traffic on many north/south streets).

- Proof-of-Payment System: would feature ticket- dispensing machines on loading islands or nearby sidewalks; would eliminate need for patrons entering Geary buses to pass by operator to pay a fare or show a transfer; would utilize roving inspectors to cite individuals caught without proper proof-of-payment. A proof-of-payment system would offer the significant advantage of speeding up loading by enabling patrons to enter the vehicle by any door at any time.

- Computer-Controlled Traffic Signal System: would have the capability of altering the general traffic signaling system as appropriate to react to predetermined bus priority criteria and varying traffic conditions.

- Gradual replacement of vehicles with low floor vehicles; would speed up loading.

The TSM, as defined for the purposes of this study, involved only the pre-empting of certain traffic signals. As indicated in Figure 13, and in more detail in Table 5A, the TSM Alternative is estimated to cost $33.0 million in 1994 dollars,

primarily to cover the cost of the additional buses needed to carry the additional patronage anticipated because of demographic changes.

2. Alternative 2 Subway Surface Light Rail (with three east end routing options; namely Geary Alternatives 2A and 2B, and an alternative developed as part of the Citywide Fixed Guideway Study featuring a terminal at the foot of Pine or Bush Street).

As described in Section II H, this alternative, under any of the three east end options, features light rail vehicles running in mixed flow traffic from the west end of Geary to 39th Avenue, then in a surface median to Laguna, then in subway to Taylor. From Taylor, the options vary. Options 1 and 2 are Geary Corridor alternatives 2A and 2B. They are described in Section II H and shown in Figure 12B. Option 3 is the Citywide Fixed Guideway Study option. It is also shown in Figure 12B.

> Option 1 (Geary Corridor Alternative 2A) would route light rail vehicles on the surface of Market Street. In terms of routing, this option is regarded as doing the best job of taking people where they want to go (given that the employment centroid of downtown San Francisco is located at the intersection of Market and Sansome Streets).
>
> To ensure that rail vehicles could travel expeditiously along the surface of Market Street, it would be necessary to take certain steps to limit the access of private automobiles to lower Market Street (such as preventing southbound Stockton Street automobiles from turning left onto Market).
>
> Option 2 (Geary Corridor Alternative 2B) would route light rail vehicles under Third and Howard to a subway terminal station at Howard and Beale. Under this option, Geary Corridor travelers wishing to reach lower Market Street destinations would have a choice of transferring to a Market Street bus, or walking (partly on mezzanine level moving sidewalks) from Third Street to the Montgomery MUNI/Metro Station, or walking back to Market Street from Howard Street. This option would improve service to the south of Market area.
>
> Option 3 (Citywide Fixed Guideway Study Alternative, with terminal at the foot of Pine or Bush Street) would provide direct access from the Geary Line to the Montgomery Street Station and to Financial District destinations.

As indicated in Figure 13, and in more detail in Tables 5B and 5C, the cost of this package is estimated to range in cost from $654.1 million to $899.8 million in 1994 dollars, depending upon which east end option is selected.

3. Alternative 3 Subway Surface Electric Trolley Bus

As described in Section II H, this alternative features electric trolley buses running in mixed flow traffic from the west end of Geary to 37th Avenue, then in

a surface median to either Laguna (under Alternative 3B) or Taylor (under Alternative 3C), then in subway under Geary, Third and Howard to separate eastbound and westbound portals on Howard, then on the surface of Howard to a terminal at or east of Beale Street.

As indicated in Figure 13, and in more detail in Tables 5E and 5F, the cost of this package is estimated to range in cost from $484.8 million to $686.7 million in 1994 dollars, depending upon whether Geary Corridor Alternative 3C or 3B is selected.

As can be seen from Figure 11, the electric bus alternatives are cheaper to operate and maintain than the light rail alternatives. In addition, because of lower utility relocation costs, the absence of track work, shorter and fewer stations, cheaper vehicles, and a shorter tunnel, the electric trolley bus alternatives are substantially less expensive to develop than the equivalent light rail alternatives. However, trolley coach options have received almost no public support.

Electric Trolley Bus Alternative 3C would be substantially less costly to design and construct than Electric Trolley Bus Alternative 3B; however it would require surface running through the congested section of Geary between Gough and Taylor, with heavy cross traffic interference at Franklin, Van Ness, Polk, Larkin and Hyde.

4. Alternative All-Surface Light Rail

As described in Section II H, this alternative features light rail vehicles running in mixed flow traffic from the westerly terminal to 39th Avenue, then in a surface median to Gough, then in traffic to the east end of the line at either the Transbay Terminal or the foot of Market Street. (A variant of Alternative 4 would be to operate using electric trolley buses rather than light rail.)

As indicated in Figure 13, and in more detail in Table 5G, this alternative (assuming light rail operation) is estimated to cost $333.9 million in 1994 dollars, significantly less than any of the subway/surface alternatives.

To ensure that rail vehicles could travel expeditiously along the surface of Market Street, it would be necessary to take certain steps to limit the access of private automobiles to lower Market Street (such as preventing southbound Stockton Street automobiles from turning left onto Market).

One major concern with the all-surface rail alternative is that to provide expeditious and reliable transit service along the surface of Geary between Gough and Market, it will be necessary to make a series of far reaching street changes including shifting the entrance of the Union Square Garage from Geary to Post, diverting cars from Geary at several points (thus changing the Market-to-Gough section of Geary from an arterial to a local street), and converting Post from an eastbound arterial to a westbound arterial. Yet without significant street changes, the quality of rail service along the Market-to-Gough

section would be insufficient to justify the cost of developing a surface light rail alternative.

Recommendation No. 2: that on behalf of meeting the objectives of Recommendation 1, the four packages described above be advanced into the next (Major Investment Study) phase of the federal implementation and funding process.

C. Patronage Forecasting. Projecting public transit patronage in San Francisco has been hampered for many years by the limited applicability of the Metropolitan Transportation Commission's (MTC's) forecasting model to this city.

At various times, various city departments have called for San Francisco either to work with MTC to better adapt the MTC model to San Francisco, or to develop a separate City of San Francisco model.

In any event, an accurate means of forecasting future public transit patronage is badly needed as a tool for evaluating the various public transit fixed guideway systems currently under consideration.

Recommendation No. 3: that a sophisticated patronage forecasting model that can be accurately applied to San Francisco County be developed forthwith.

D. Costing Methodology. Each year MUNI submits a Section 15 Report to the Federal Transportation Administration delineating MUNI's annual operating and maintenance (O&M) costs. MUNI's 1993 costs as set forth in the latest Section 15 Report formed the basis of the Geary Corridor O&M cost estimates. During the course of the Geary study a concern arose over the accuracy of the Section 15 Reports.

Recommendation No. 4: that MUNI conduct an independent analysis of the Section 15 Report and make methodology adjustments as appropriate.

E. The BART Regional Alternative. Pursuant to a resolution adopted by the BART Board of Directors on July 14, 1994, the effect of a regional BART Geary regional line on four of the proposed Geary Corridor MUNI lines was evaluated. The results of this BART-sponsored effort were set forth in a separate report entitled "The BART Regional Alternative: Its Effect on MUNI". Based upon the results of the BART study, it was concluded that:

- constructing a Geary branch of the BART system from Market Street, through the Geary Corridor to approximately Seventh Avenue, where BART would

leave the Geary Corridor, would be insufficient to meet the needs of many Geary Corridor travelers, and therefore would not preclude the need for a separate MUNI fixed guideway system designed to improve Geary Corridor transit services;

- regional rail lines linking Northbay counties to San Mateo County and the Eastbay counties could create significant travel opportunities for public transit users and are therefore deserving of further study; and

- additional data and analysis are needed to fully identify the routing, feasibility, and patronage which could be generated by providing additional regional rail transit services in the Westbay and Northbay Counties.

Recommendation No. 5: that if BART is interested in improving regional transit connections on the north and west sides of San Francisco Bay, that it initiate a more definitive study designed to find the best way of extending its system, or otherwise serving the areas not now adequately served by BART.

APPENDICES

GEARY CORRIDOR SYSTEM
PLANNING STUDY

APPENDIX A
THE THIRTY-ONE INITIAL CANDIDATES

An initial list of thirty-one possible Geary Corridor alternatives was defined by the Project Team. The alternatives are described below, and compared in Figure A-1. (Please note that the numbers used to identify the below-listed initial list of alternatives were dropped during the screening process).

The **"No Build"** Alternative: This alternative was advanced to the screening stage.

The **Transportation Systems Management (TMS)** Alternative: This alternative was advanced to the screening stage.

Alternative 7.1: **BART** subway extension via Civic Center and Geary to 48th Avenue. This alternative was advanced to the screening stage.

Alternative 7.2: **BART** subway extension via O'Farrell and Geary to 48th Avenue. This alternative was dropped because of the high cost of fitting a BART branch line into the existing Market Street BART level at a downtown location.

Alternative 6.1: **Muni Metro Light Rail Transit (LRT)** subway extension via Civic Center and Geary to 48th Avenue. This alternative was dropped because it failed to provide adequate service to the Tenderloin/Union Square area and because of the difficulties involved in adding a new branch line to the existing Market Street LRT system.

Alternative 6.2: **Muni Metro LRT** subway extension via O'Farrell and Geary to 48th Avenue. This alternative was dropped because of the difficulties involved in adding a new branch line to the existing Market Street LRT system.

Alternative 5.1: Geary **LRT** subway/surface line from Kearny and Bush to 48th Avenue, with provision for eventual subway extension northward under Kearny. This alternative was advanced to the screening stage.

Alternative 5.2: Geary/O'Farrell **LRT** subway/surface line from Transbay Terminal to 48th Avenue using the surface tracks on Market Street. This alternative was advanced to the screening stage.

Alternative 5.3: Geary/O'Farrell **LRT** subway/surface line from Transbay Terminal to 48th Avenue using the surface of Mission, Third and Fourth Streets, with provision for surface connection to the Bayshore Corridor line. This alternative was dropped because of the conflicts between LRT travel and surface traffic on Third, Fourth, and Mission Streets.

Alternative 5.4: Post/**Peter Yorke**/Geary **LRT** subway/surface line from the foot of Post Street to 48th Avenue. This alternative was advanced to the screening stage.

Alternative 5.5: Post/**Union Square**/Geary **LRT** subway/surface line from the foot of Post Street to 48th Avenue. This alternative was dropped because the Peter Yorke Way Geary/Post crossing location was judged to be cheaper and better than the proposed Union Square crossing.

Alternative 5.6: First/Bush/Kearny/Post/**Peter Yorke**/Geary **LRT** subway/surface line from the Transbay Terminal to 48th Avenue using a **shallow** subway under Market Street . This alternative was dropped because there is insufficient room above the existing Market Street subway for a shallow subsurface crossing at First Street.

Alternative 5.7: First/Bush/Kearny/Post/**Union Square**/Geary **LRT** subway/surface line from the Transbay Terminal to 48th Avenue using a **shallow** subway under Market Street . This alternative was dropped because there is insufficient room above the existing Market Street subway for a shallow subsurface crossing.

Alternative 5.12: First/Bush/Kearny/Post/**Peter Yorke**/Geary **LRT** subway/surface line from the Transbay Terminal to 48th Avenue via a **deep** subway under Market Street . This alternative was dropped because of high cost and because under this alternative the track level of the Market Street station would have to be approximately 120 feet below the surface of Market Street.

Alternative 5.13: First/Bush/Kearny/Post/**Union Square**/Geary **LRT** subway/surface line from the Transbay Terminal to 48th Avenue via a **deep** subway under Market Street . This alternative was dropped because of high cost and because under this alternative the track level of the Market Street station would have to be approximately 120 feet below the surface of Market Street.

Alternative 5.9: Third/Geary **LRT** subway/ surface line from **two way portal on Third south of Bryant** to 48th Avenue, with **shallow** subway under Market Street and provision for southerly extension to the Bayshore Corridor line. This alternative was modified such that the southerly terminal was shifted from Third and Bryant to Howard and Beale. The modified alternative was advanced to the screening stage.

Alternative 5.10: Fourth/Mission/Third/Geary **LRT** subway/surface line from **portals on Third and Fourth south of Mission** to 48th Avenue, with **shallow** subway under Market Street and provision for southerly extension to the Bayshore Corridor line. This alternative was modified to shift the Third and Fourth Street portals to locations south of Bryant Street. The modified alternative was advanced to the screening stage.

Alternative 5.11: Fourth/Mission/Third/Geary **LRT** subway/surface line from **portals on Third south of Mission and Howard east of Fourth** to 48th Avenue, with **shallow** subway under Market Street and provision for southerly extension to the Bayshore Corridor line. This alternative was dropped because of traffic and other difficulties with a Howard Street portal location.

Alternative 5.14: Third/Geary **LRT** subway/ surface line from two way portal on Third south of Bryant to 48th Avenue, with **deep** subway under Market Street and provision for southerly extension to the Bayshore Corridor line. This alternative was dropped because of high cost and because under this alternative the track level of the Market Street station would have to be approximately 120 feet below the surface of Market Street.

Alternative 5.15: Fourth/Mission/Third/Geary **LRT** subway/ surface line from portals on Third and Fourth south of Mission to 48th Avenue, with **deep** subway under Market Street and provision for southerly extension to the Bayshore Corridor line. This alternative was dropped because of high cost and because under this alternative the track level of the Market Street station would have to be approximately 120 feet below the surface of Market Street.

Alternative 5.16: Fourth/Mission/Third/Geary **LRT** subway/surface line from portals on Third south of Mission and Howard east of Fourth to 48th Avenue, with **deep** subway under Market Street and provision for southerly extension to the Bayshore Corridor line. This alternative was dropped because of high cost and because under this alternative the track level of the Market Street station would have to be approximately 120 feet below the surface of Market Street.

Alternative 3.1: Mission/Third/Geary **electric bus** subway/surface line from Transbay Terminal to 48th Avenue, with **mixed flow** bus travel west of the **Laguna** Street portal. This alternative was modified to shift the downtown leg from Mission to Howard with portals on Howard in the vicinity of First and Second Streets. The modified alternative was advanced to the screening stage.

Alternative 3.2: Mission/Third/Geary **electric bus/dual mode bus** subway/surface line from Transbay Terminal to 48th Avenue, with **mixed flow** bus travel west of the **Laguna** Street portal. This alternative was modified to shift the downtown leg from Mission to Howard with portals on Howard in the vicinity of First and Second Streets. The modified alternative was advanced to the screening stage.

Alternative 3.3: Mission/Third/Geary **electric bus** subway/surface line from Transbay Terminal to 48th Avenue, with **median** bus travel west of the **Laguna** Street portal. This alternative was modified to shift the downtown leg from Mission to Howard with portals on Howard in the vicinity of First and

Second Streets. The modified alternative was advanced to the screening stage.

Alternative 3.4: Mission/Third/Geary **electric bus/dual mode bus** subway/surface line from Transbay Terminal to 48th Avenue, with **median** bus travel west of the **Laguna** Street portal. This alternative was modified to shift the downtown leg from Mission to Howard with portals on Howard in the vicinity of First and Second Streets. The modified alternative was advanced to the screening stage.

Alternative 3.5: Mission/Third/Geary **electric bus** subway/surface line from Transbay Terminal to 48th Avenue, with **mixed flow** bus travel west of the **Taylor** Street portal. This alternative was modified to shift the downtown leg from Mission to Howard with portals on Howard in the vicinity of First and Second Streets. The modified alternative was advanced to the screening stage.

Alternative 3.6: Mission/Third/Geary **electric bus/dual mode bus** subway/surface line from Transbay Terminal to 48th Avenue, with **mixed flow** bus travel west of the **Taylor** Street portal. This alternative was modified to shift the downtown leg from Mission to Howard with portals on Howard in the vicinity of First and Second Streets. The modified alternative was advanced to the screening stage.

Alternative 3.7: Mission/Third/Geary **electric bus** subway/surface line from Transbay Terminal to 48th Avenue, with **median** bus travel west of the **Taylor** Street portal. This alternative was modified to shift the downtown leg from Mission to Howard with portals on Howard in the vicinity of First and Second Streets. The modified alternative was advanced to the screening stage.

Alternative 3.8: Mission/Third/Geary **electric/dual mode bus** subway/surface line from Transbay Terminal to 48th Avenue, with **median** bus travel west of the **Taylor** Street portal. This alternative was modified to shift the downtown leg from Mission to Howard with portals on Howard in the vicinity of First and Second Streets. The modified alternative was advanced to the screening stage.

Alternative 4.1: **Surface LRT** line from Transbay Terminal via Fremont and First/Market/O'Farrell and Geary/Starr King to 48th Avenue. This alternative was advanced to the screening stage.

Alternative 4.2: **Surface LRT** line from Transbay Terminal via Fremont and First/Market/Geary to 48th Avenue. This alternative was modified to include a transit mall between Mason and the foot of Geary and advanced to the screening stage.

ALTERNATIVES COMPARISON CHART

Alternative		Subway Cover (Feet)	Length (mile) Surface 2-Dir.	Surface 1-Dir	Subway 2-Dir.	Subway 1-Dir	Max Grade (%)	Minimum Horizontal Curve (Feet)	Minimum Vertical Curve (Feet)	Assumed Design Speed (mph)	Service Interconnection Van Ness Corridor	North Beach Corridor	Bayshore Corridor	R/W Take	Major Utility Conflicts	Detour Impacts	Cost	Constructability	Reference Drawings	Initial 2nd Screen Candidates
7.1	1A	85			5.6		4	550	1000		YES	NO	NO	MOD	POTEN	MOD		A,B,C,D,E,F	SK-5,7,10	●
7.2	1B	50			5.7		4	550	1000		YES	NO	NO	MOD	POTEN	MOD		M	SK-5,6,7	
5.1	2A	25	4.5		1.6		9	90	500		YES	YES	NO	MOD	POTEN	MOD		A,B,C,D,G,H,J,K	SK-5,6,7	●
5.2	2B	25	4.9	1.5	0.8	0.6	9	150	500		YES	NO	YES	MOD	POTEN	MOD		A,B,C,D,G,H,J,K	SK-5,6,7	●
5.3	2C	25	4.5		1.4		9	150	500		YES	NO	YES	MOD	POTEN	MOD		A,B,C,D,G,H,J,K	SK-5,6,7	●
5.4	2D	25	4.5		1.7		9	90	500		YES	NO	NO	MOD	POTEN	MOD		A,B,C,D,G,H,J,K,L	SK-5,6,7	●
5.9	2E	10	4.5		1.6	0.7	9	90	500		YES	NO	YES	MOD	POTEN	MOD		A,B,C,D,G,H,J,K,L	SK-5,6,7	●
5.10		10	4.5				9	90	500		YES	NO	YES	MOD	POTEN	MOD		A,B,C,D,G,H,K,L	SK-5,6,7	●
3.1	3A	10	4.5		1.7		9	90	500		YES	FUTURE	YES	MOD	POTEN	MOD		A,B,C,D,G,H,K,L	SK-5,6,7	●
3.2	3B	10	4.5		1.7		9	90	500		YES	FUTURE	YES	MOD	POTEN	MOD		A,B,C,D,G,H,K,L	SK-5,6,7	●
3.3	3C	10	4.5		1.7		9	90	500		YES	FUTURE	YES	MOD	POTEN	MOD		A,B,C,D,G,H,J,K,L	SK-5,6,7	●
3.4	3D	10	4.5		1.7		9	90	500		YES	FUTURE	YES	MOD	POTEN	MOD		A,B,C,D,G,H,J,K,L	SK-5,6,7	●
3.5	4A	---	5.0	2.7			9	150	500		YES	FUTURE	YES	NONE	MIN	MOD		G	SK-3,4	●
4.2	4B	---	6.1				9	150	500		YES	NO	YES	NONE	MIN	MAJOR		G	SK-3,4	●
6.1		10			5.6		7	90	500		YES	NO	NO	MOD	POTEN	MOD		A,B,C,D,E,F	SK-5,7	
6.2		10			5.7		7	150	500		YES	NO	NO	MOD	POTEN	MOD		A,B,C,D,E,F	SK-5,7	
5.5		25	4.5		1.5		9	150	500		YES	NO	NO	MOD	POTEN	MOD		A,B,C,D,G,H,J,K	SK-5,7	
5.6		75	4.5		1.5		9	90	500		YES	NO	NO	MOD	POTEN	MOD		A,B,C,D,F,G,H,J,K	SK-5,7	
5.7		75	4.5		1.8		9	90	500		YES	NO	NO	MOD	POTEN	MOD		A,B,C,D,F,G,H,J,K	SK-5,7	
5.11		10	4.5		1.5	0.2	9	90	500		YES	NO	YES	MOD	POTEN	MOD		A,B,C,D,F,G,H,J,K	SK-5,7	
5.12		75	4.5		1.9		9	90	500		YES	NO	NO	MOD	POTEN	MOD		A,B,C,D,F,G,H,J,K	SK-5,7	
5.13		75	4.5		1.9		9	90	500		YES	NO	NO	MOD	POTEN	MOD		A,B,C,D,F,G,H,J,K	SK-5,7	
5.14		75	4.5		1.9		9	150	500		YES	NO	YES	MOD	POTEN	MOD		A,B,C,D,F,G,H,J,K	SK-5,7	
5.15		75	4.5		1.4	0.4	9	90	500		YES	NO	YES	MOD	POTEN	MOD		A,B,C,D,F,G,H,J,K	SK-5,7	
5.16		75	4.5		1.5	0.2	9	90	500		YES	NO	YES	MOD	POTEN	MOD		A,B,C,D,F,G,H,J,K	SK-5,7	
	3E	10	4.5	1.4	0.7	0.1	9	90	500		YES	YES	YES	MOD	POTEN	MAJOR		A,B,C,D,G,H,K,L	SK-5,6,7	
	3F	10	4.5	1.4	0.7	0.1	9	90	500		YES	YES	YES	MOD	POTEN	MAJOR		A,B,C,D,G,H,K,L	SK-5,6,7	
	3G	10	4.5	1.4	0.7	0.1	9	90	500		YES	YES	YES	MOD	POTEN	MAJOR		A,B,C,D,G,H,J,K,L	SK-5,6,7	
	3H	10	4.5	1.4	0.7	0.1	9	90	500		YES	YES	YES	MOD	POTEN	MAJOR		A,B,C,D,G,H,J,K,L	SK-5,6,7	

Alternatives:

1: Full Subway BART
2 & 5: Partial Subway LRT
3: Electric Trolley Bus
4. All Surface Line, LRT
6. Full Subway LRT

CONSTRUCTIBILITY LEGEND

A. Subway Structures (SK-5)
B. Subway Station Structure
C. Various Foundation Underpinning
D. Tight Radius
E. Exist Tunnel Break-out
F. Subway Crossing Exist. Tunnel
G. Viaduct (SK-3,SK-4)
H. Viaduct Station (SK-9)
J. Surface Station (SK-1, SK-2)
K. Portal Structure
L. Shallow Subway (SK-8)
M. In-bound Subway can not meet min length and grade requirement.

LEGEND:

● Second Screen Candidate

Figure A-1

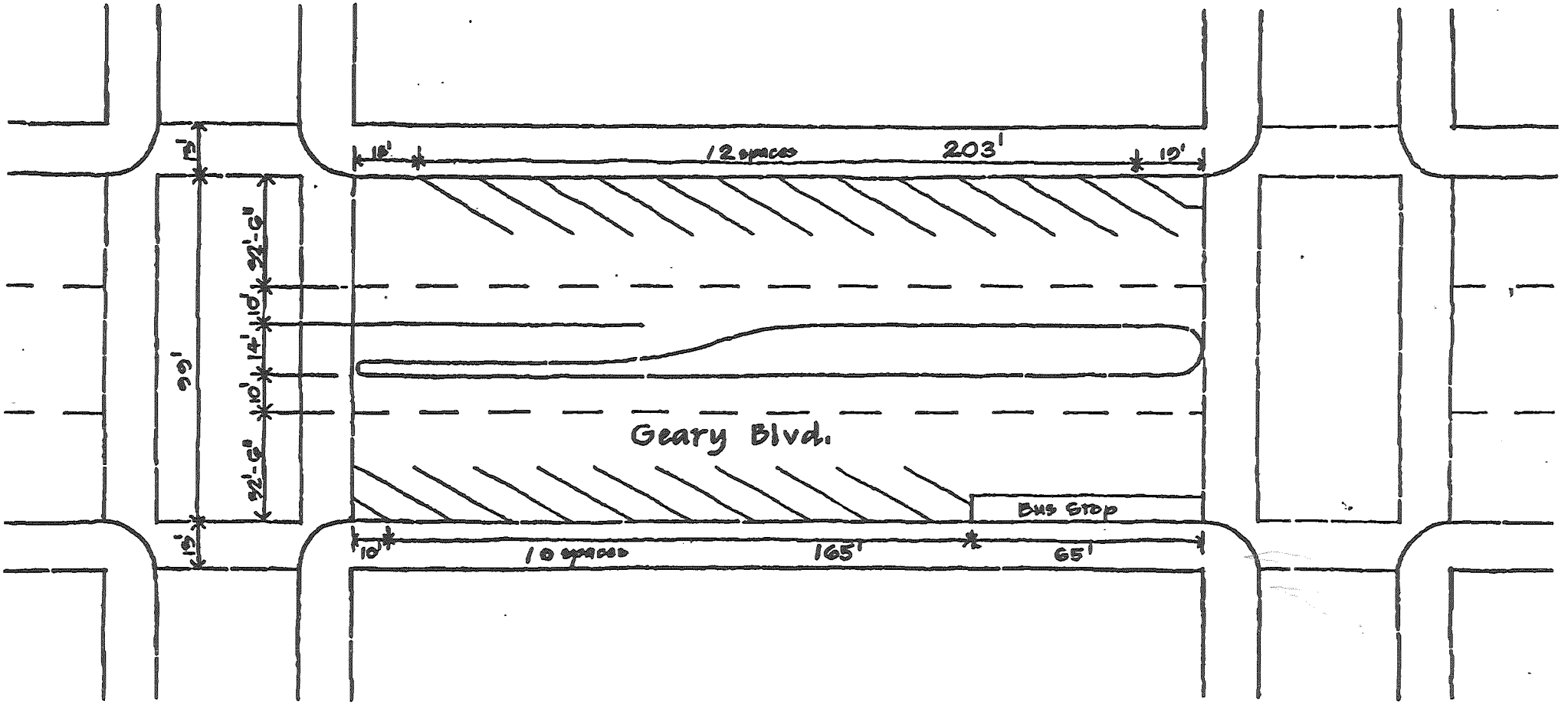
c:\work\grycorr\screen.xls 2/28/94

GEARY CORRIDOR SYSTEM
PLANNING STUDY

APPENDIX B
THE OUTER GEARY MEDIAN OPERATION

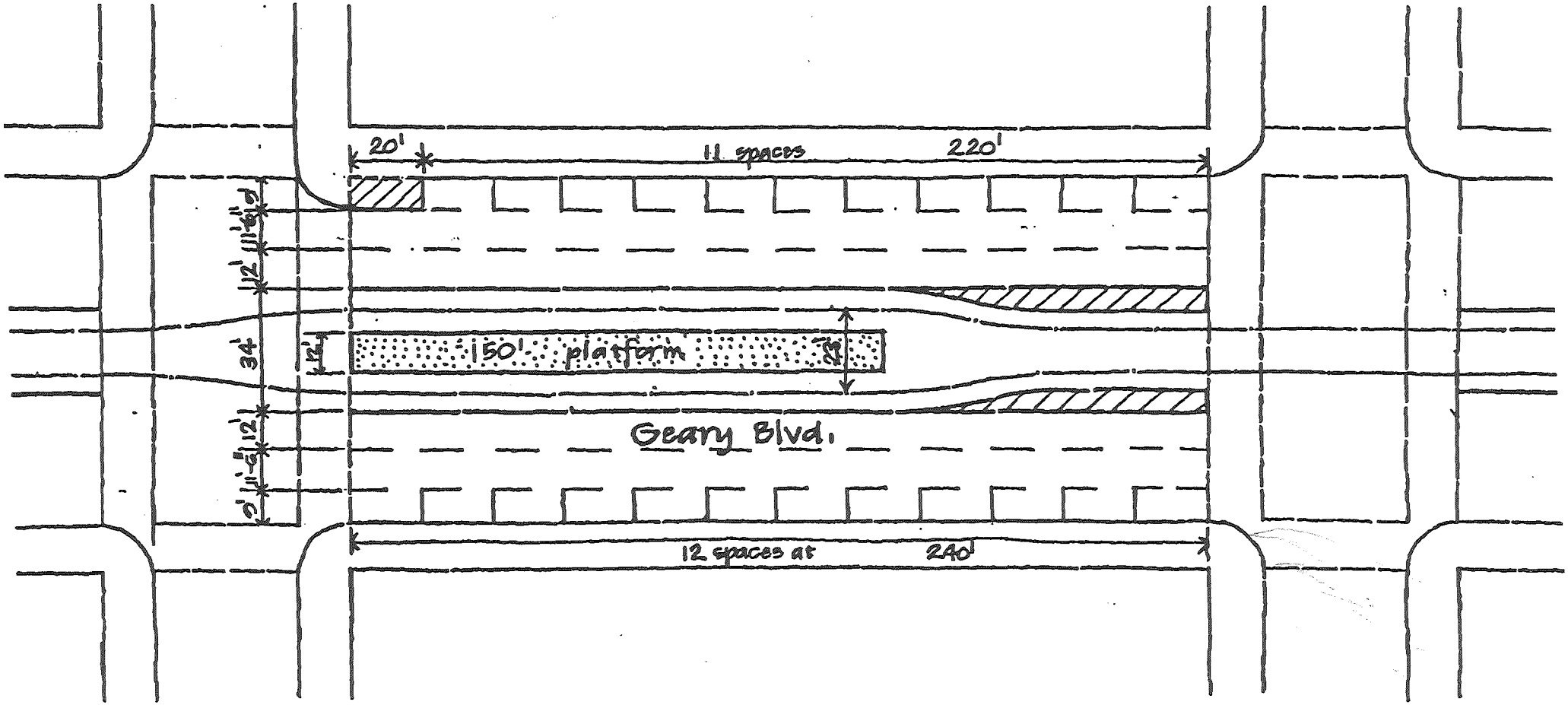
The Outer Geary Median Operation

Following are drawings showing various ways of operating in a separate Geary transit median between 37th Avenue and Laguna:



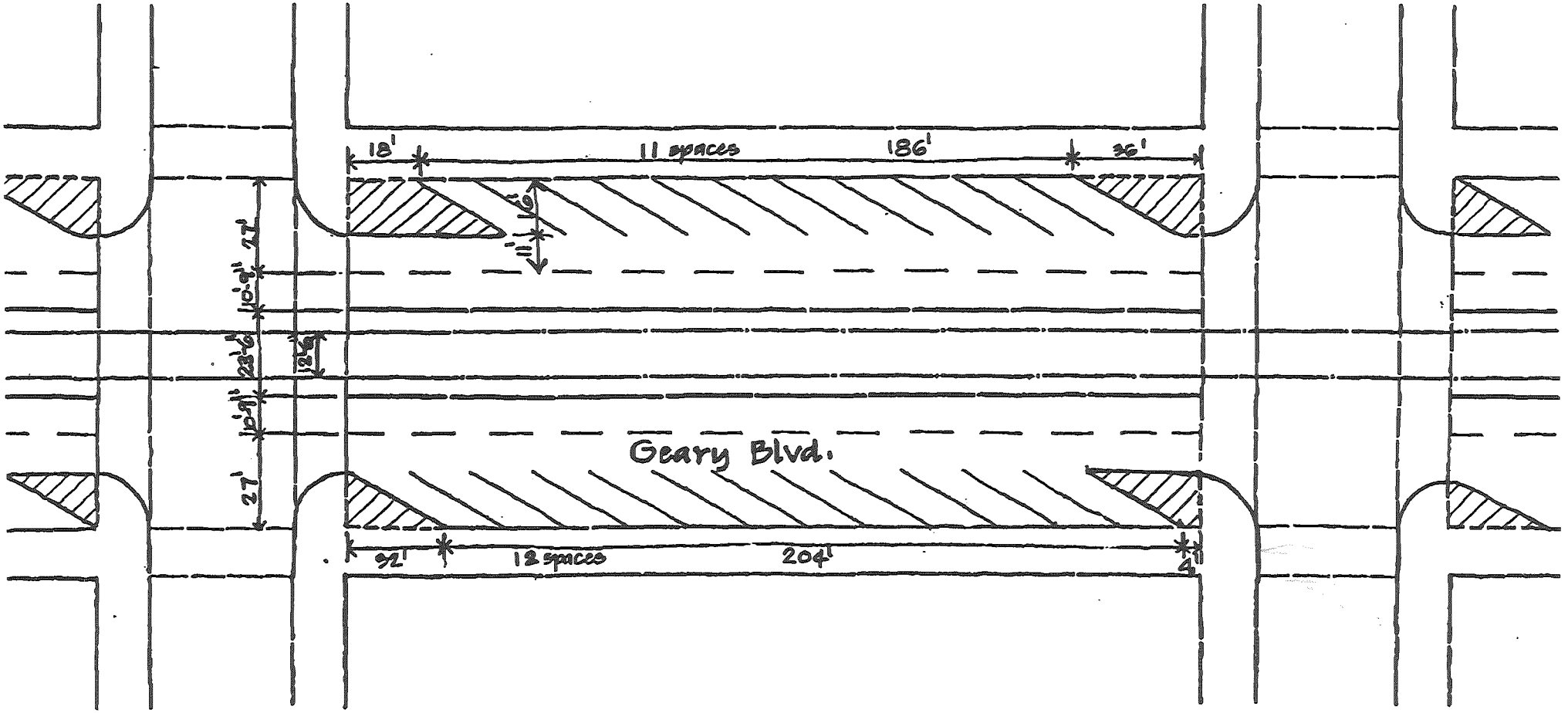
EXISTING

Figure B-1



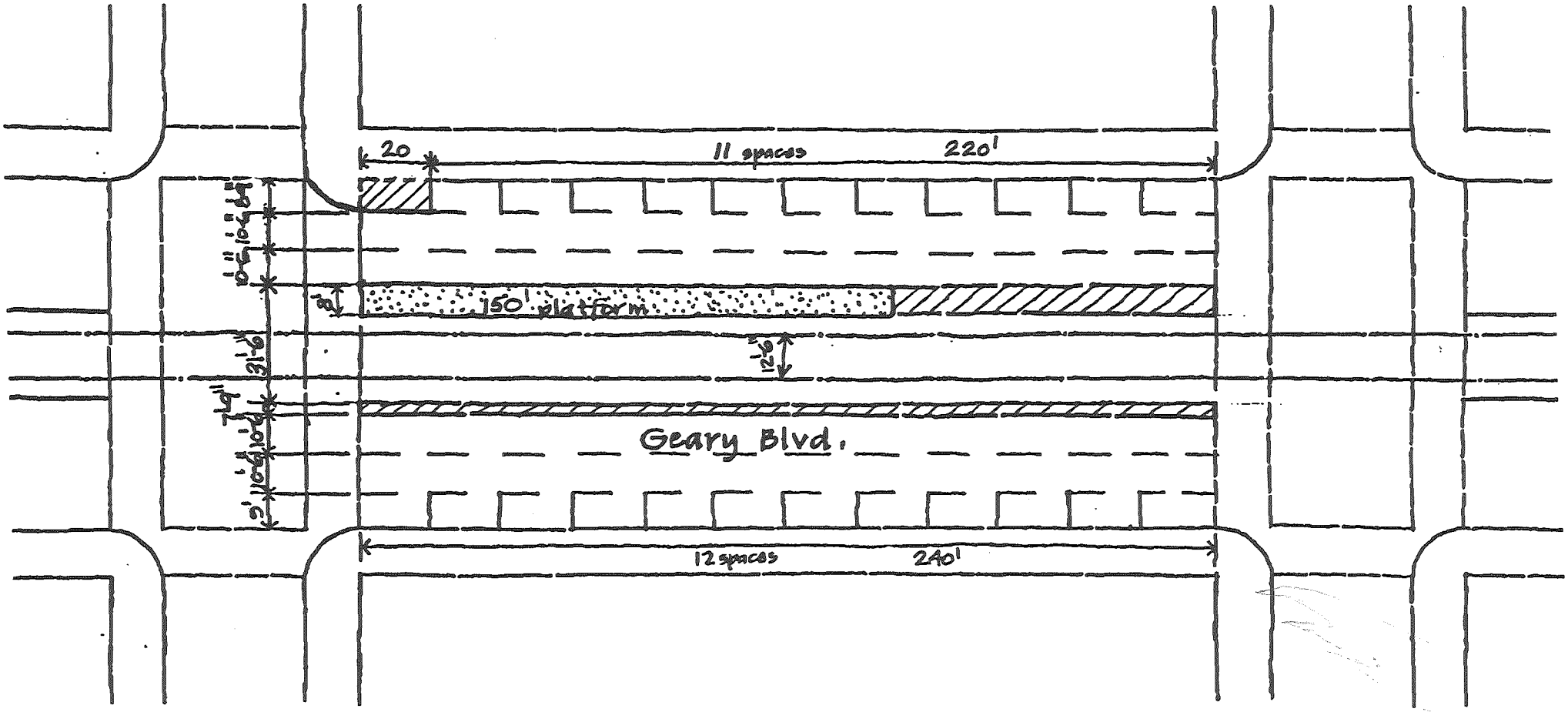
LRT - Center Loading at LRT Stop

Figure B-2



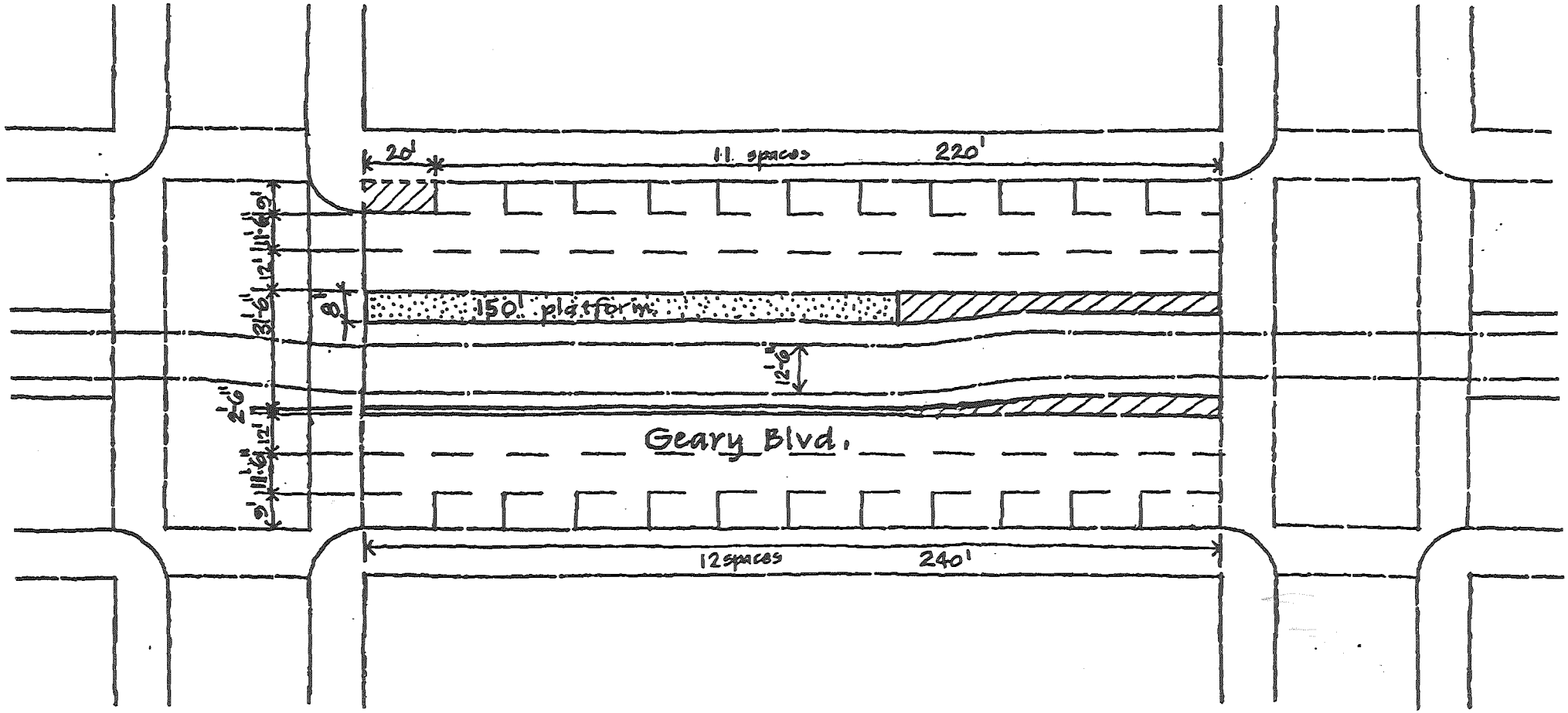
LRT - Center Loading (Between LRT Stops)

Figure B-3



LRT - Side Loading at LRT Stop
(℄ track at ℄ Geary Blvd.)

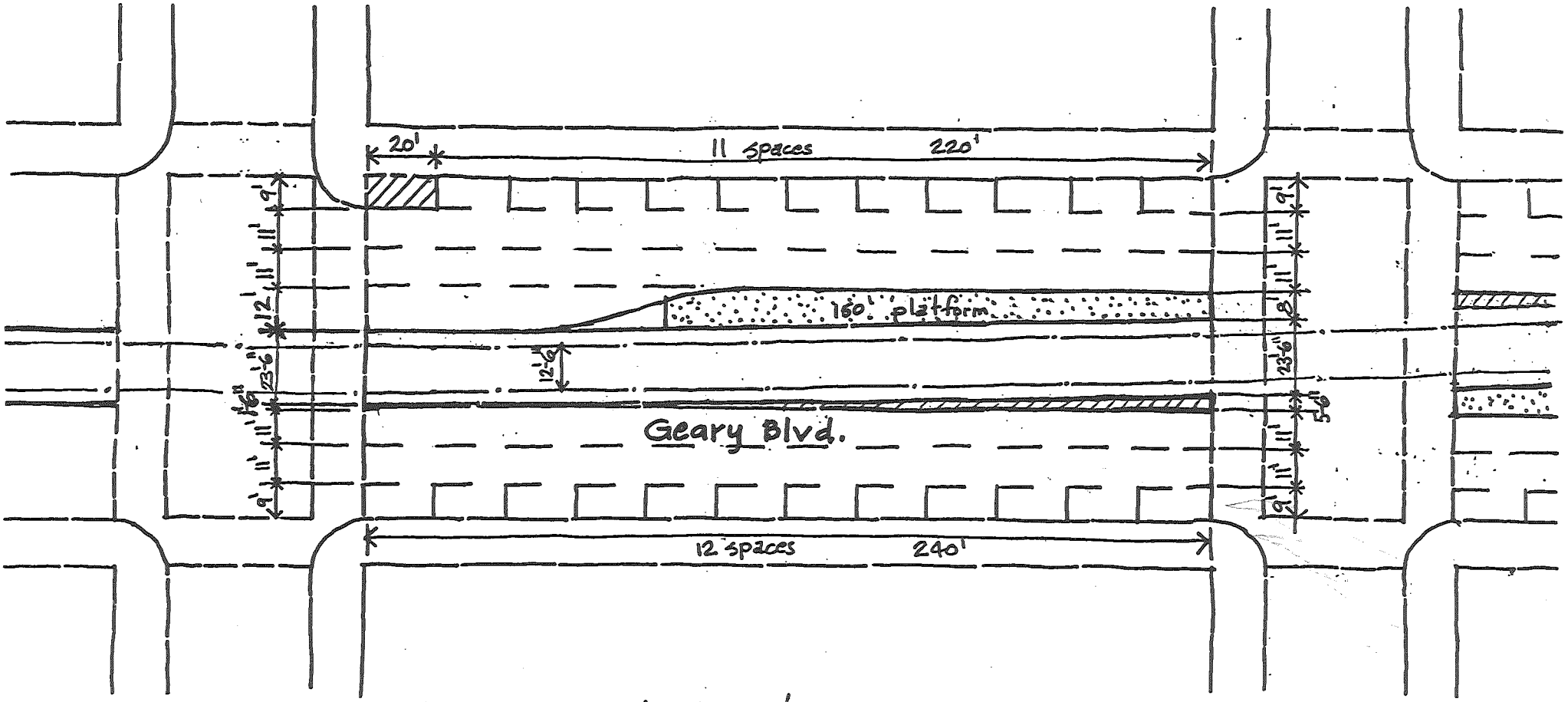
Figure B-4



LRT - Side Loading at LRT Stop

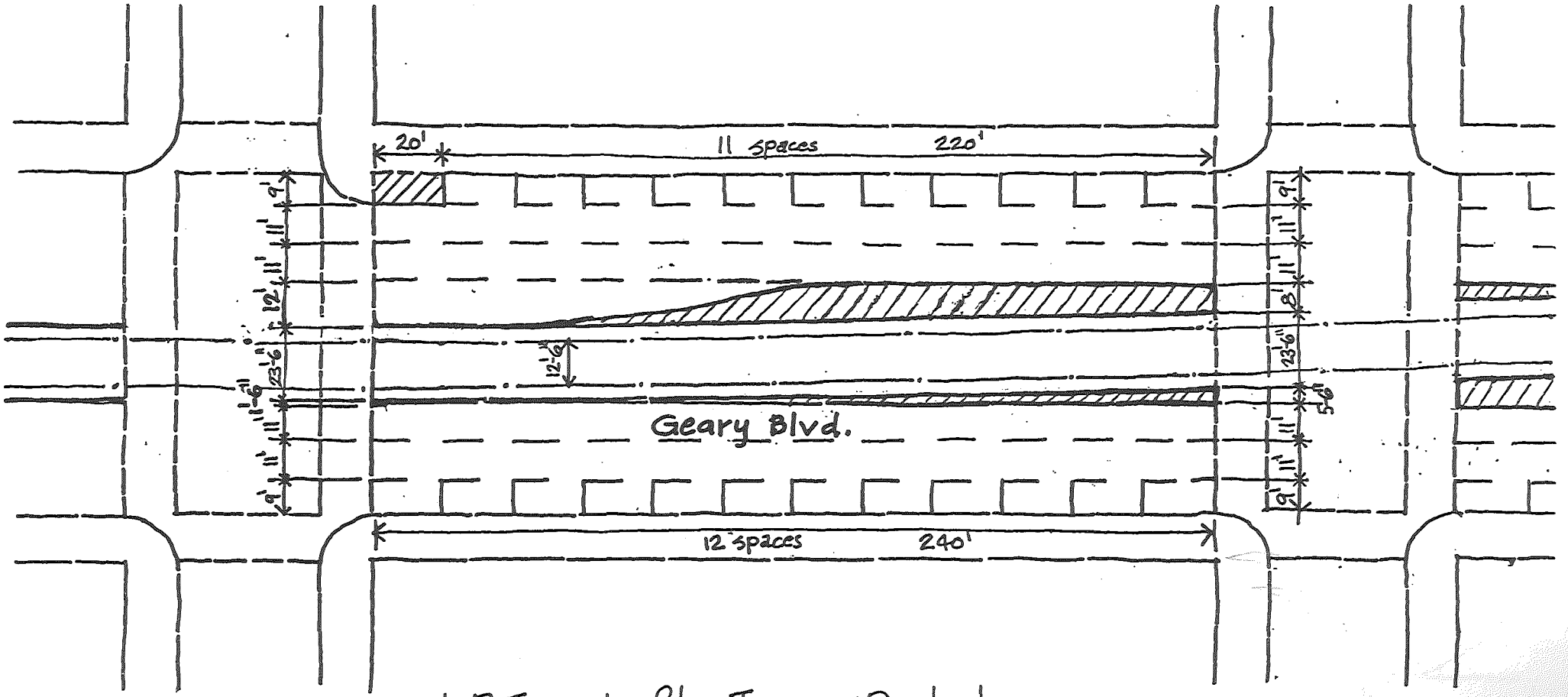
(℄ track 2.75' south of ℄ Geary Blvd.)

Figure B-5



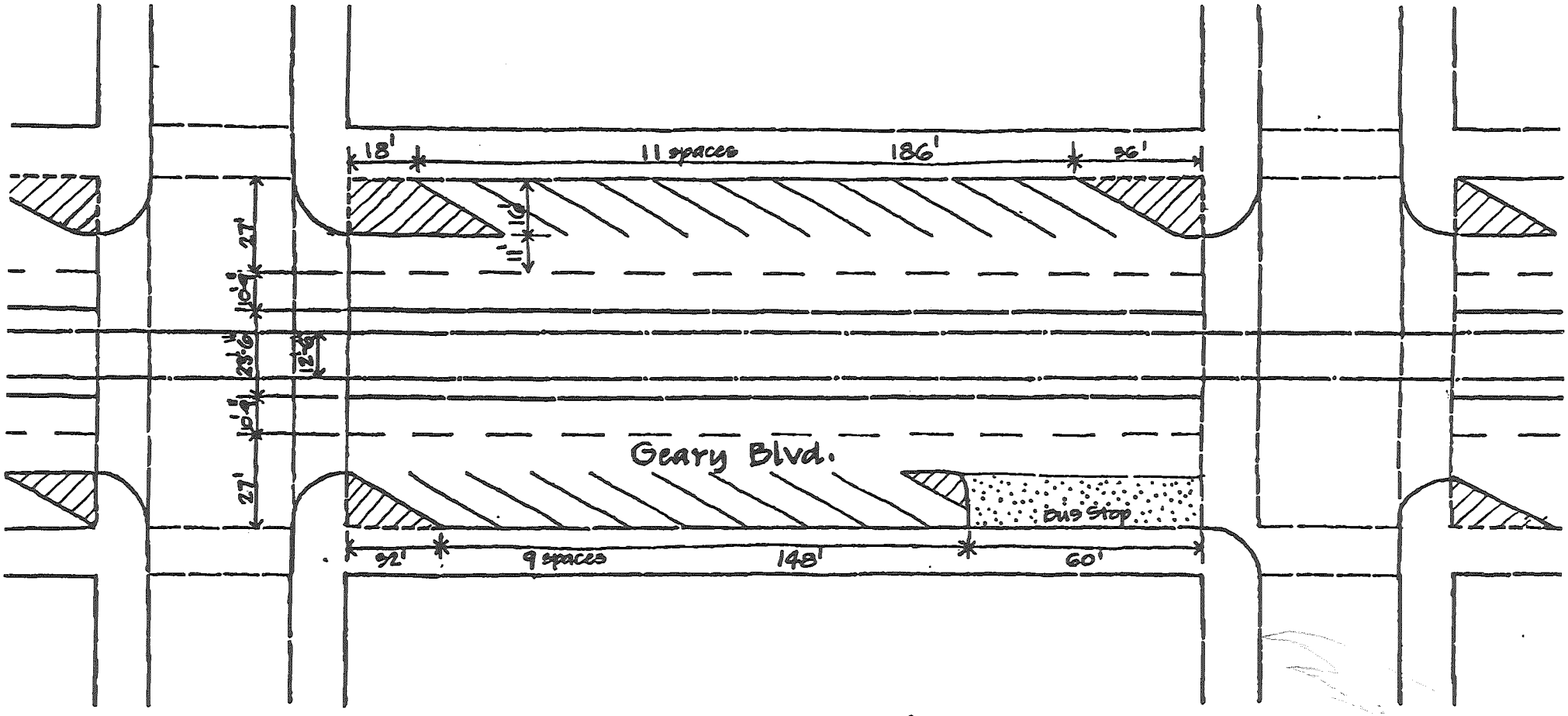
LRT - Side Loading LRT Stop
& Left Turn Pocket
(℄ track 5.25' south of ℄ Geary Blvd.) max.

Figure B-6



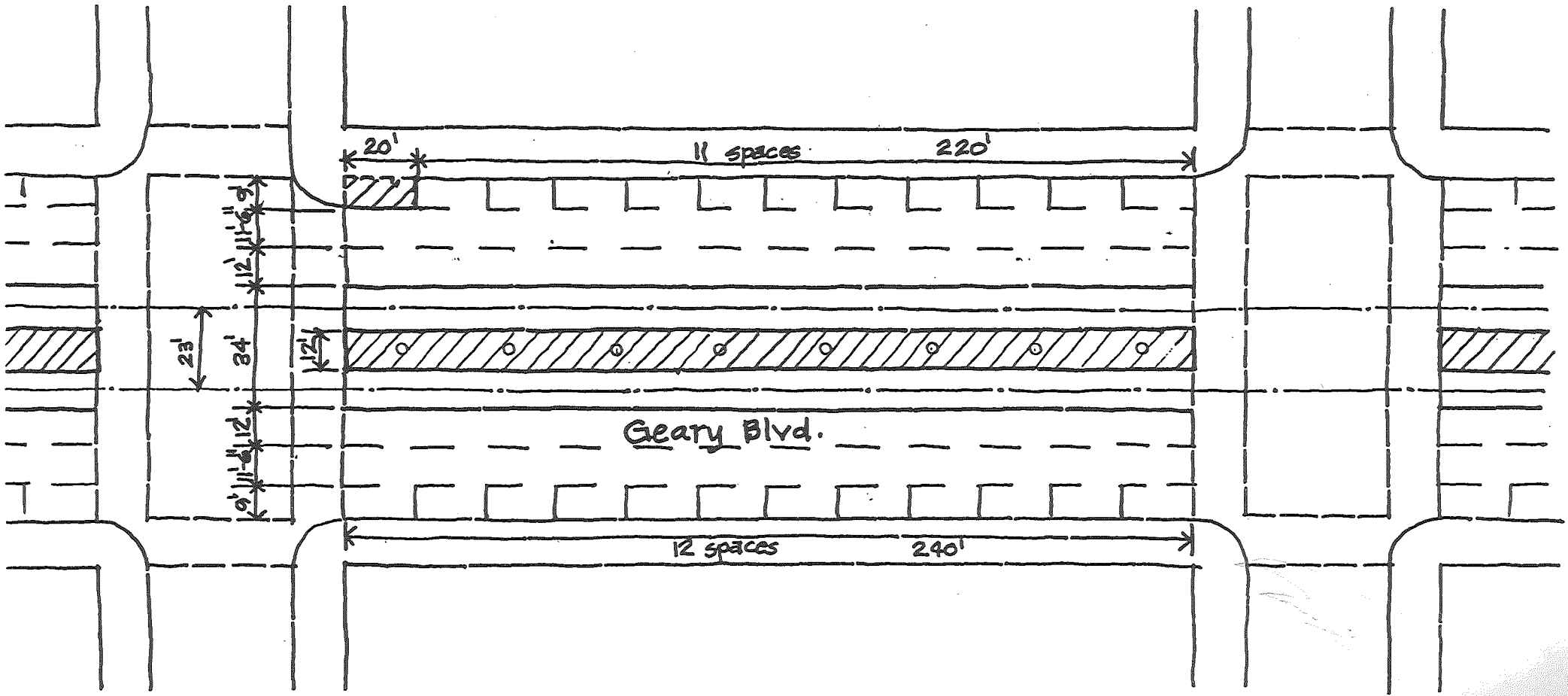
LRT - Left Turn Pocket
(℄ track 5.25' south of ℄ Geary Blvd.) max.

Figure B-7



LRT - Side Loading (Between LRT Stops)

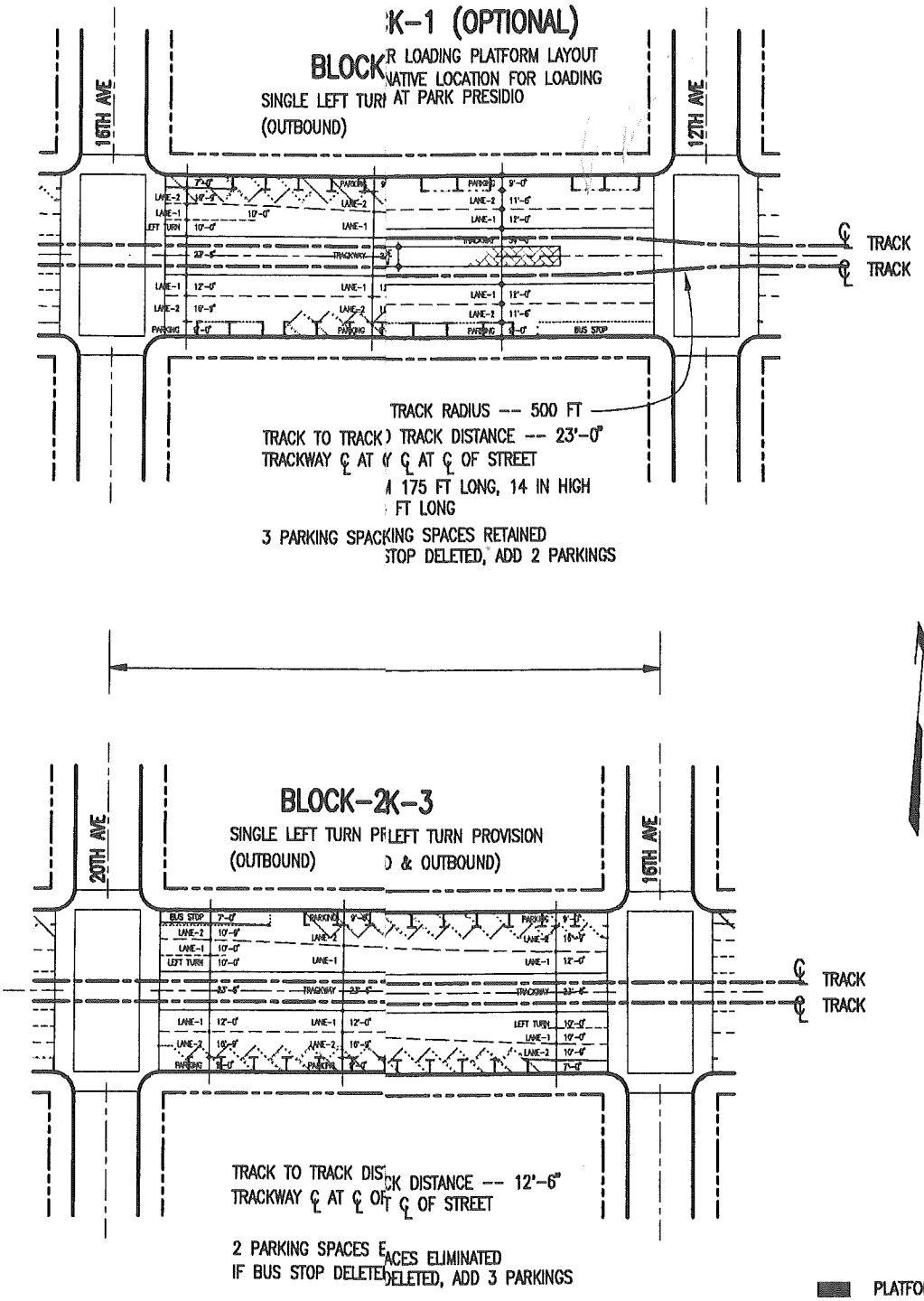
Figure B-8



LRT - Planted Median (Between LRT stops)

Figure B-9

Figure B-10



THIS PRINT REDUCED

2	042595	ADJUSTED NOS OF PARKINGS	VY	
1	052394	ADDED BUS STOPS/PARKINGS INFO	VY	
No.	DATE	DESCRIPTION	BY	APPR'D

REVISIONS

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES

FILE NAME:SK-1

MUNI METRO SYSTEM
GEARY CORRIDOR TRANSIT
PLANNING STUDY

PROPOSED TRACKWAY LAYOUT – SCHEME 1
FROM 12TH AVE TO 20TH AVE

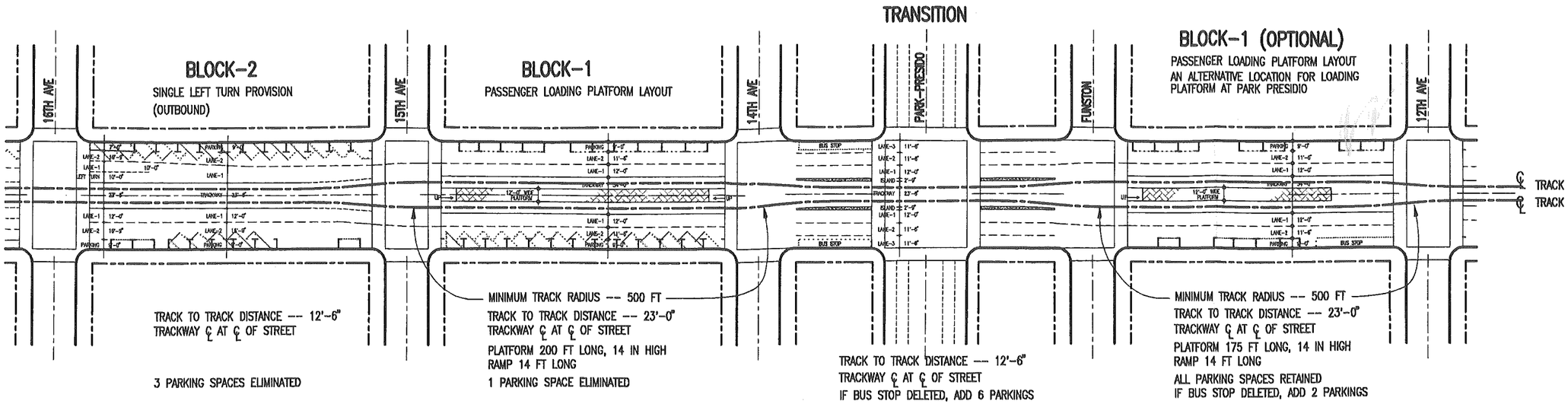
CONTRACT No: MR-XXXX

DRAWING No: CL-XXXX

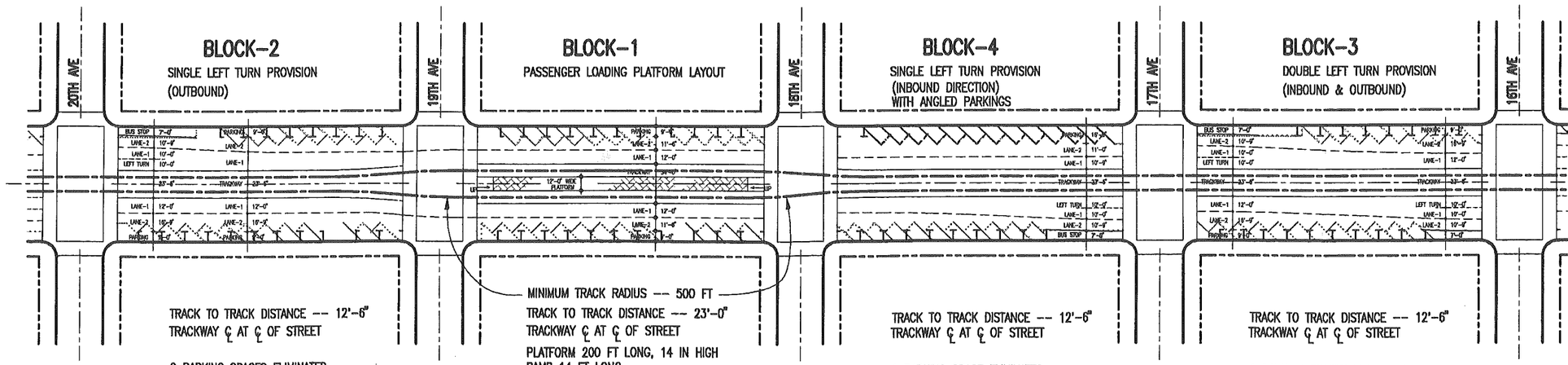
SK-1 / SK-8

REVISION No. 1

Figure B-10



A TYPICAL 4–BLOCK LAYOUT
1240 FEET LONG



THIS PRINT REDUCED

CENTERED LOADING PLATFORM –– CENTERED TRACKWAY

- MAXIMUM LEFT TURN PROVISIONS
- NARROW LEFT TURN LANES
- 10 PARKING SPACES ELIMINATED ON THIS DWG
- IF ALL BUS STOPS DELETED, ADD 16 SPACES TO NEW PARKING ON THIS DWG

50' 0' 50' 100'
GRAPHIC SCALE IN FEET
1" = 50'–0"

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
FILE NAME:SK–1

No.	DATE	DESCRIPTION	BY	APPR'D
2	042595	ADJUSTED NOS OF PARKINGS	VV	
1	052394	ADDED BUS STOPS/PARKINGS INFO	VV	

REVISIONS

DESIGNED:
DRAWN:
CHECKED:
REVIEWED:
APPROVED:
RECOMMENDED:
SCALE:
DATE:

CITY AND COUNTY OF SAN FRANCISCO
PUBLIC UTILITIES COMMISSION
UTILITIES ENGINEERING BUREAU

APPROVED — MANAGER UTILITIES ENGINEERING BUREAU
APPROVED — GENERAL MANAGER SAN FRANCISCO MUNICIPAL RAILWAY

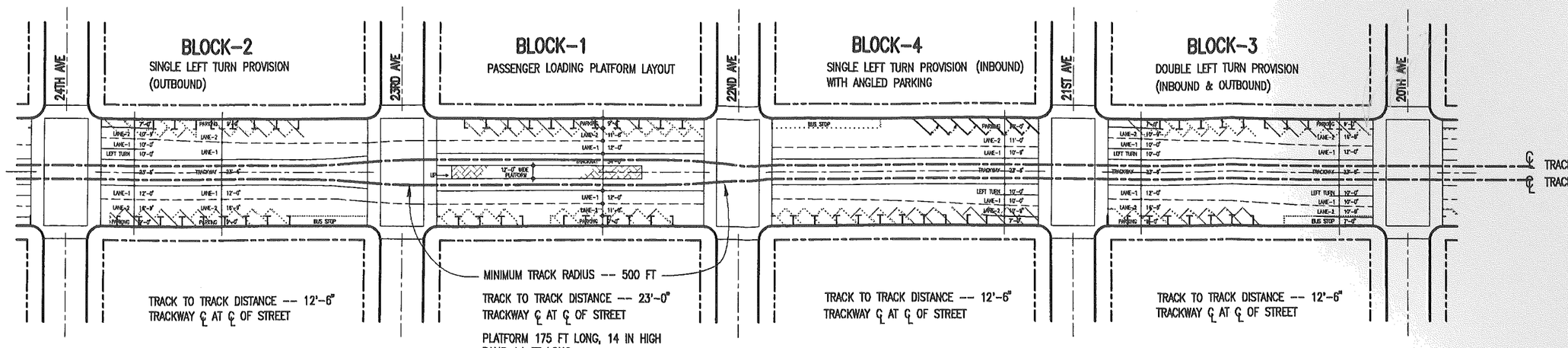
MUNI METRO SYSTEM
GEARY CORRIDOR TRANSIT
PLANNING STUDY

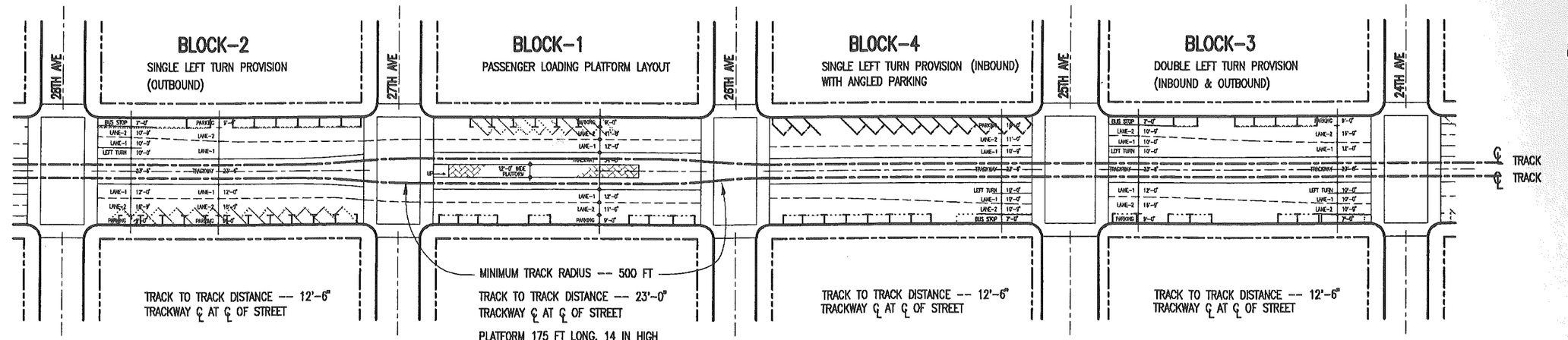
PROPOSED TRACKWAY LAYOUT – SCHEME 1
FROM 12TH AVE TO 20TH AVE

CONTRACT No: MR–XXXX
DRAWING No: CL–XXXX
SK–1 / SK–8
REVISION No. 1

Figure B-11

A TYPICAL 4-BLOCK LAYOUT
1240 FEET LONG





PLATFORM
EXISTING PARKING

THIS PRINT REDUCED

CENTERED LOADING PLATFORM -- CENTERED TRACKWAY

- MAXIMUM LEFT TURN PROVISION
- NARROW LEFT TURN POCKETS
- 19 PARKING SPACES ELIMINATED ON THIS DWG
- IF ALL BUS STOPS DELETED, ADD 13 SPACES TO NEW PARKING ON THIS DWG

50' 0' 50' 100'
GRAPHIC SCALE IN FEET
1" = 50'-0"

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
FILE NAME:SK-2

No.	DATE	DESCRIPTION	BY	APP'D
2	042595	ADJUSTED NOS OF PARKINGS	VY	
1	052394	ADDED BUS STOPS/PARKINGS INFO	VY	

REVISIONS

DESIGNED:
DRAWN:
CHECKED:
REVIEWED:
APPROVED:
RECOMMENDED:
SCALE:
DATE:

CITY AND COUNTY OF SAN FRANCISCO
PUBLIC UTILITIES COMMISSION
UTILITIES ENGINEERING BUREAU

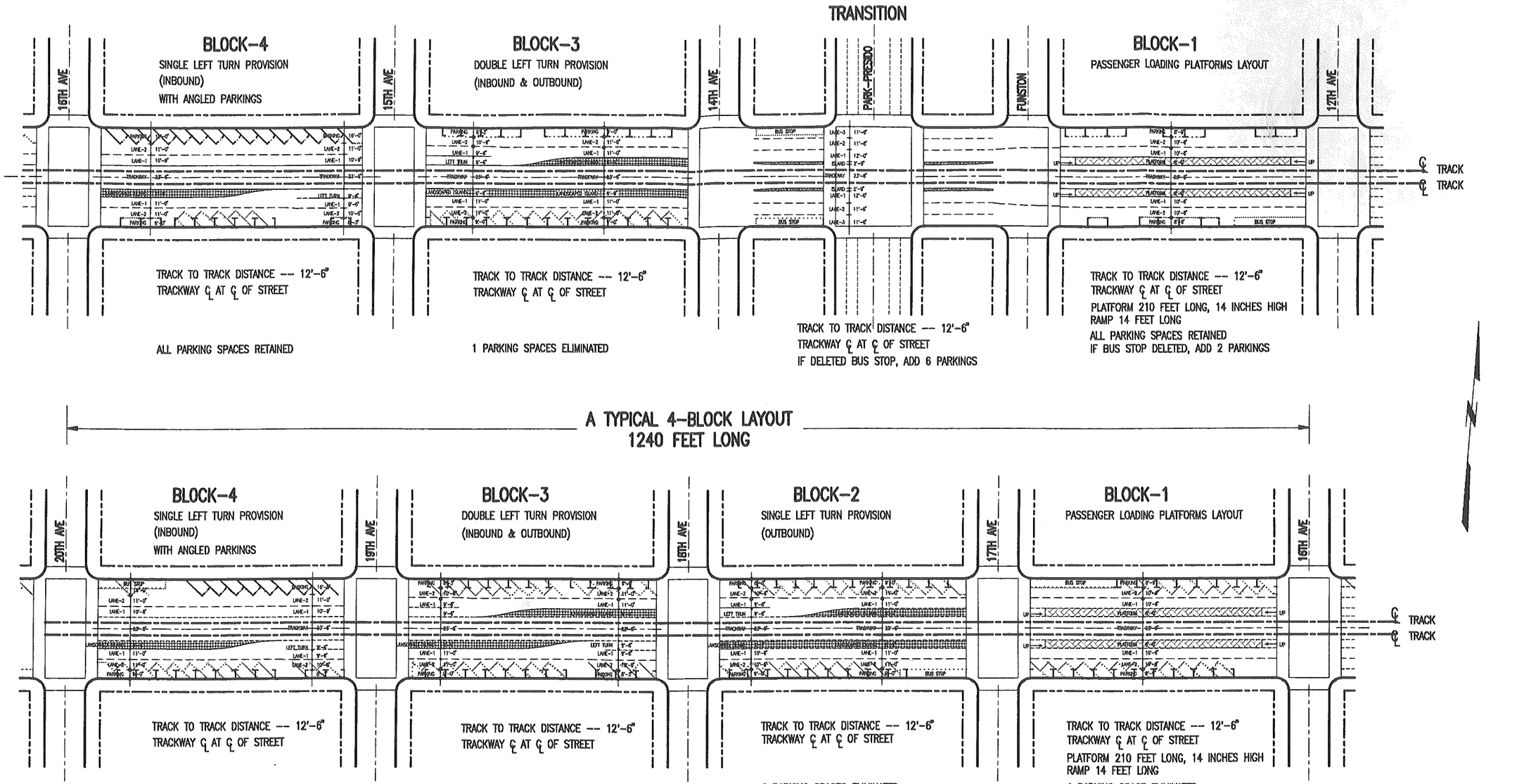
APPROVED — MANAGER UTILITIES ENGINEERING BUREAU
APPROVED — GENERAL MANAGER SAN FRANCISCO MUNICIPAL RAILWAY

MUNI METRO SYSTEM
GEARY CORRIDOR TRANSIT
PLANNING STUDY

PROPOSED TRACKWAY LAYOUT - SCHEME 1
FROM 20TH AVE TO 28TH AVE

CONTRACT No: MR-XXXX
DRAWING No: CL-XXXX
SK-2 / SK-8
REVISION No. 2

Figure B-12



THIS PRINT REDUCED

SIDE LOADING PLATFORM –– CENTERED TRACKWAY

- MAXIMUM LEFT TURN PROVISIONS
- NARROW LEFT TURN LANES
- 7 PARKING SPACES ELIMINATED ON THIS DWG
- IF ALL BUS STOPS DELETED, ADD 16 SPACES TO NEW PARKING ON THIS DWG

50' 0' 50' 100'
GRAPHIC SCALE IN FEET
1" = 50'–0"

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
FILE NAME:SK–3

No.	DATE	DESCRIPTION	BY	APP'D
2	042595	ADJUSTED NOS OF PARKINGS	VY	
1	052394	ADDED BUS STOPS/PARKINGS INFO	VY	

REVISIONS

DESIGNED:
DRAWN:
CHECKED:
REVIEWED:
APPROVED:
RECOMMENDED:
SCALE:
DATE:

CITY AND COUNTY OF SAN FRANCISCO
PUBLIC UTILITIES COMMISSION
UTILITIES ENGINEERING BUREAU

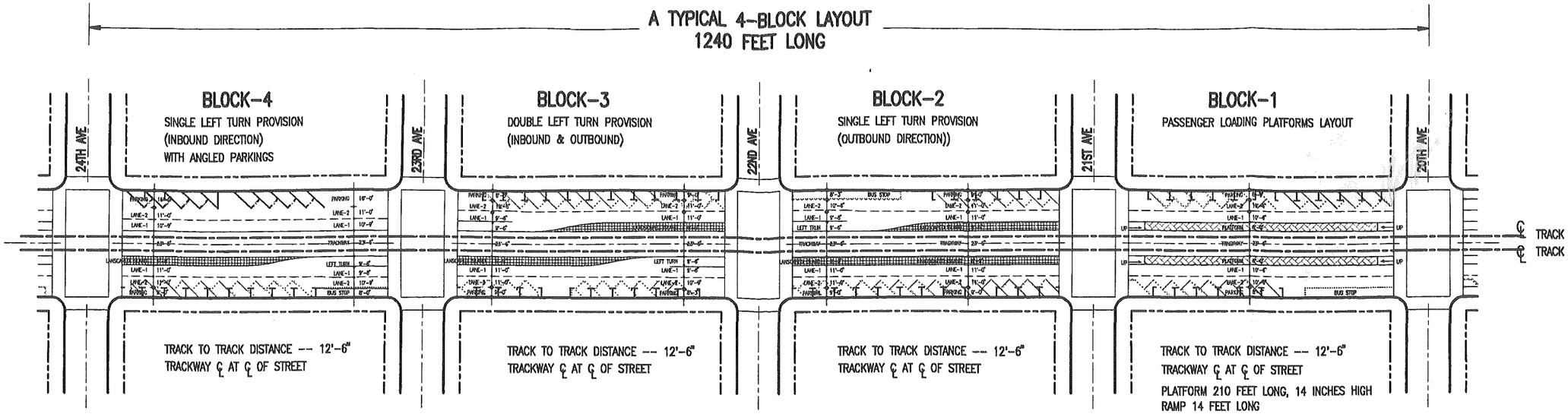
APPROVED — MANAGER, UTILITIES ENGINEERING BUREAU
APPROVED — GENERAL MANAGER, SAN FRANCISCO MUNICIPAL RAILWAY

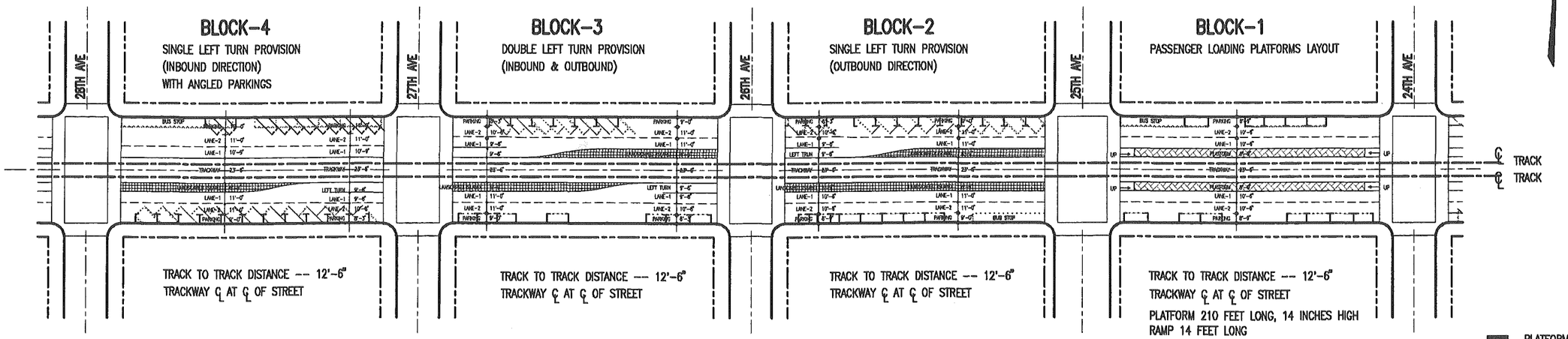
MUNI METRO SYSTEM
GEARY CORRIDOR TRANSIT
PLANNING STUDY

PROPOSED TRACKWAY LAYOUT – SCHEME 2
FROM 12TH AVE TO 20TH AVE

CONTRACT No.: MR–XXXX
DRAWING No.: CL–XXXX
SK–3 / SK–8
REVISION No. 2

Figure B-13





THIS PRINT REDUCED

SIDE LOADING PLATFORM -- CENTERED TRACKWAY

- MAXIMUM LEFT TURN PROVISIONS
- NARROW LEFT TURN LANES
- 8 PARKING SPACES ELIMINATED ON THIS DWG
- IF ALL BUS STOPS DELETED, ADD 13 SPACES TO NEW PARKING ON THIS DWG

50' 0' 50' 100'
GRAPHIC SCALE IN FEET
1" = 50'-0"

FOR REDUCED PLANS ORIGINAL SCALE IS IN FEET
FILENAME:SK-4

No.	DATE	DESCRIPTION	BY	APPR'D
1	052394	ADDED BUS STOPS/PARKINGS INFO	VY	

REVISIONS

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CHECKED:
REVIEWED:
APPROVED:
RECOMMENDED:
SCALE:
DATE:

CITY AND COUNTY OF SAN FRANCISCO
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MANAGER
UTILITIES ENGINEERING BUREAU

APPROVED
GENERAL MANAGER
SAN FRANCISCO MUNICIPAL RAILWAY

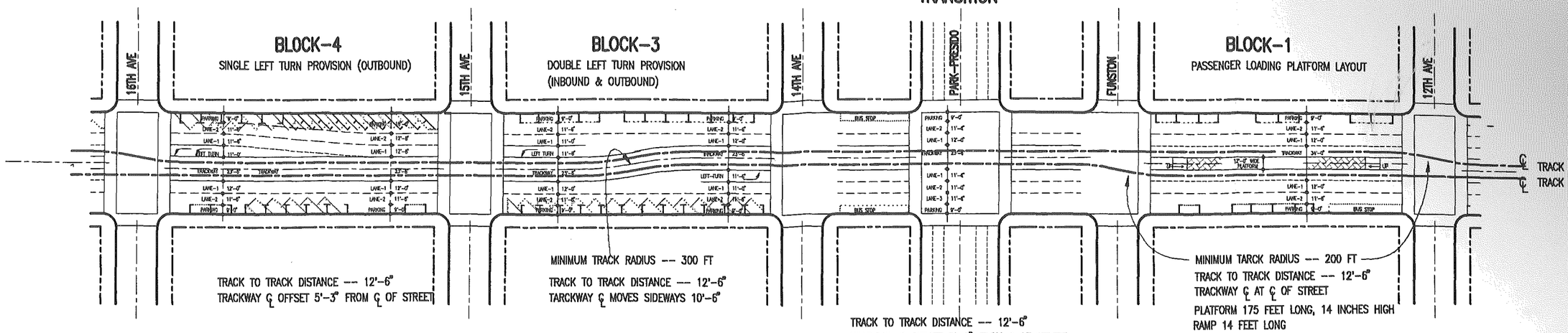
MUNI METRO SYSTEM
GEARY TRANSIT PLANNING STUDY

PROPOSED TRACKWAY LAYOUT -- SCHEME 2
FROM 20TH AVE TO 28TH AVE

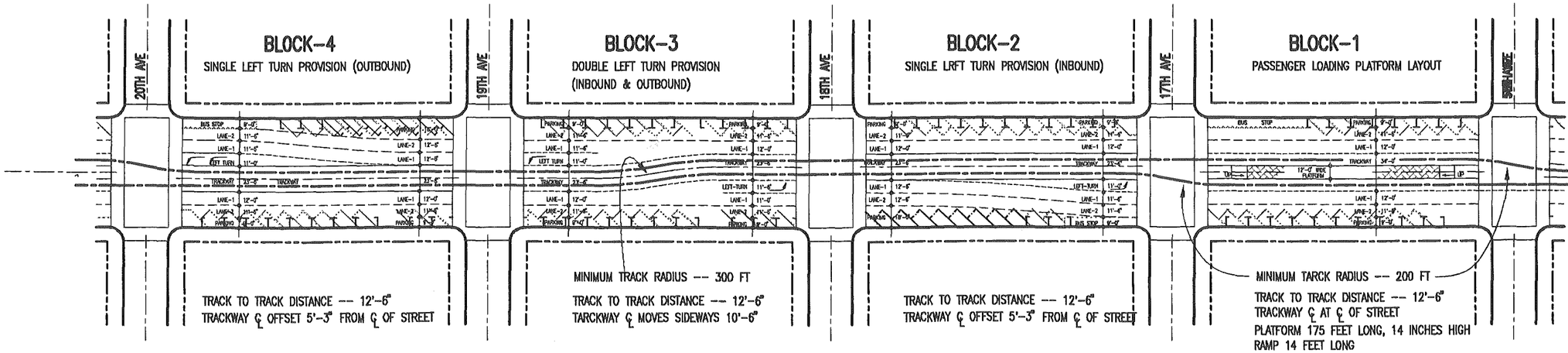
CONTRACT No: MR-XXXX
DRAWING No: CL-XXXX
SK-4
SK-8
REVISION No. 2

Figure B-14

TRANSITION



A TYPICAL 4–BLOCK LAYOUT
1240 FEET LONG



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CENTERED LOADING PLATFORM –– OFFSET TRACKWAY

- MAXIMUM LEFT TURN PROVISIONS
- SPACIOUS PARKING SPACES & TRAFFIC LANES
- 9 PARKING SPACES ELIMINATED ON THIS DWG
- IF ALL BUS STOPS DELETED, ADD 14 SPACES TO NEW PARKING ON THIS DWG

50' 0' 50' 100'
GRAPHIC SCALE IN FEET
1" = 50'–0"

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
FILENAME:SK–5

No.	DATE	DESCRIPTION	BY	APPR'D
2	042595	ADJUSTED NOS OF PARKINGS	VY	
1	052394	ADDED BUS STOP/PARKING INFO	VY	

REVISIONS

DESIGNED:
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RECOMMENDED:
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DATE:

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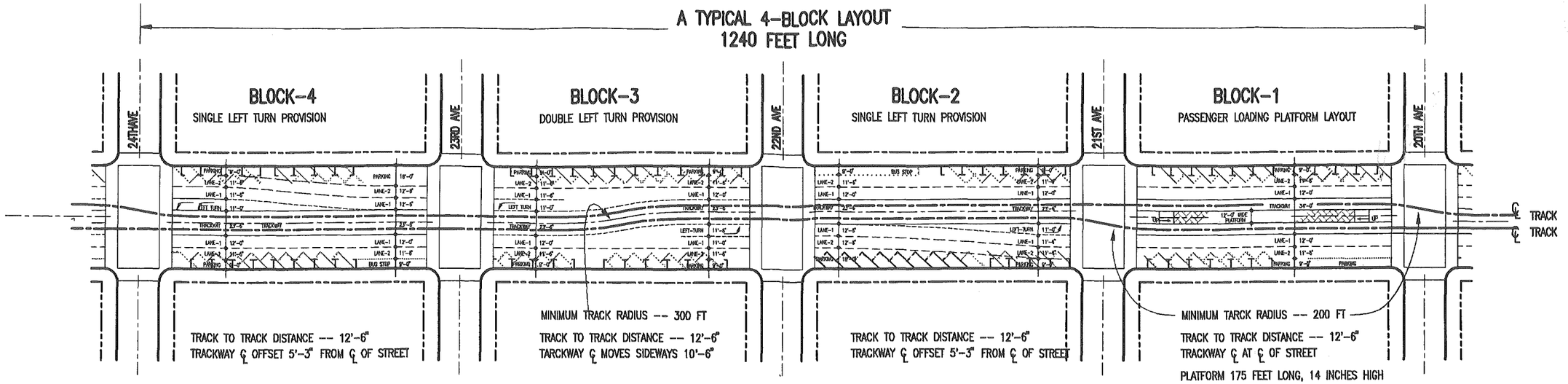
MUNI METRO SYSTEM
GEARY CORRIDOR TRANSIT
PLANNING STUDY

PROPOSED TRACKWAY LAYOUT – SCHEME 3
FROM 12TH AVE TO 20TH AVE

CONTRACT No: MR–XXXX
DRAWING No: CL–XXXX
SK–5 / SK–8
REVISION No. 2

Figure B-15



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CENTERED LOADING PLATFORM -- OFFSET TRACKWAY

- MAXIMUM LEFT TURN PROVISIONS
- SPACIOUS PARKING SPACES & TRAFFIC LANES
- 11 PARKING SPACES ELIMINATED
- IF ALL BUS STOPS DELETED, ADD 13 SPACES TO NEW PARKING ON THIS DWG

50' 0' 50' 100'
GRAPHIC SCALE IN FEET
1" = 50'-0"

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES
FILENAME:SK-6

No.	DATE	DESCRIPTION	BY	APPR'D
2	042595	ADJUSTED NOS OF PARKINGS	VY	
1	042394	ADDED BUS STOP/PARKING INFO	VY	

REVISIONS

DESIGNED:
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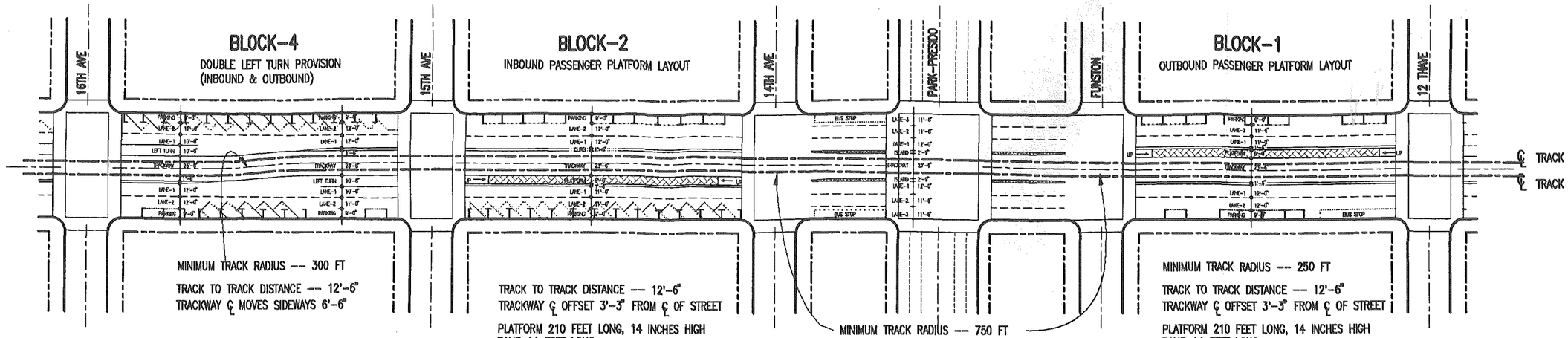
GEARY CORRIDOR TRANSIT PLANNING STUDY

PROPOSED TRACKWAY LAYOUT - SCHEME 3
FROM 20TH AVE TO 28TH AVE

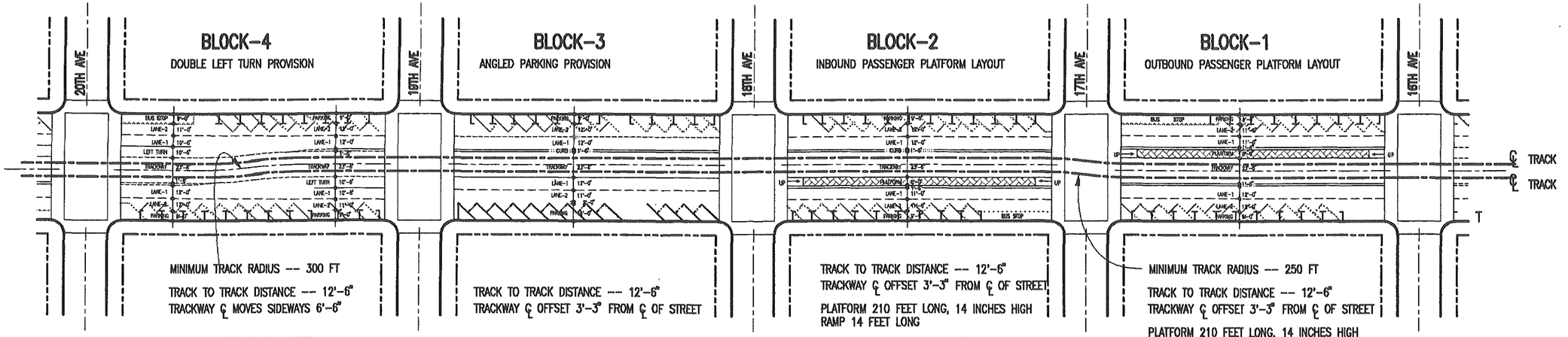
CONTRACT No: MR-XXXX
DRAWING No: CL-XXXX
SK-6 / SK-8
REVISION No. 2

Figure B-16

TRANSITION



A TYPICAL 4–BLOCK LAYOUT
1240 FEET LONG



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SIDE LOADING PLATFORM –– OFFSET TRACKWAY

- LIMITED LEFT TURN PROVISIONS
- SPACIOUS PARKINGS & TRAFFIC LANES
- 9 PARKING SPACES ELIMINATED ON THIS DWG
- IF ALL BUS STOP DELETED, ADD 16 SPACES TO NEW PARKING ON THIS DWG

50' 0' 50' 100'
GRAPHIC SCALE IN FEET
1" = 50'–0"

No.	DATE	DESCRIPTION	BY	APPR'D
2	042595	ADJUSTED NOS OF PARKINGS	VY	
1	052394	ADDED BUS STOP/PARKING INFO	VY	

REVISIONS

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES

FILENAME:SK–7

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APPROVED:
RECOMMENDED:
SCALE:
DATE:

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MUNI METRO SYSTEM
GEARY CORRIDOR TRANSIT
PLANNING STUDY

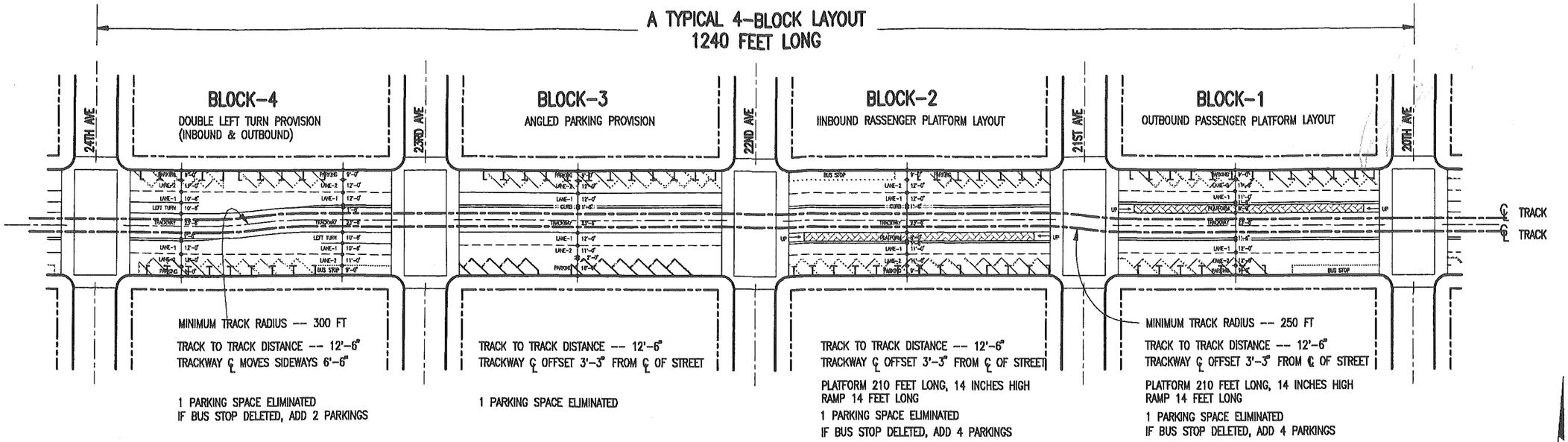
CONTRACT No: MR–XXXX
DRAWING No: CL–XXXX

PROPOSED TRACKWAY LAYOUT – SCHEME 4
FROM 12TH AVE TO 20TH AVE

SK–7 / SK–8

REVISION No. 2

Figure B-17



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SIDE LOADING PLATFORM –– OFFSET TRACKWAY

- LIMITED LEFT TURN PROVISIONS
- SPACIOUS TRAFFIC LANES & PARKINGS
- 7 PARKING SPACES ELIMINATED ON THIS DWG
- IF ALL BUS STOPS DELETED, ADD 13 SPACES TO NEW PARKING ON THIS DWG

50' 0' 50' 100'
GRAPHIC SCALE IN FEET 1" = 50'–0"

No.	DATE	DESCRIPTION	BY	APPR'D
2	042595	ADJUSTED NOS OF PARKINGS	VY	
1	052394	ADDED BUS STOPS/PARKINGS INFO	VY	

REVISIONS

FOR REDUCED PLANS ORIGIN. SCALE IS IN FEET

FILENAME:SK–8

DESIGNED:
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MUNI METRO SYSTEM
GEARY TRANSIT PLANNING STUDY

PROPOSED TRACKWAY LAYOUT – SCHEME 4
FROM 20TH AVE TO 20TH AVE

CONTRACT No: MR–XXXX
DRAWING No: CL–XXXX
SK–8 / SK–8
REVISION No. 2

GEARY CORRIDOR SYSTEM
PLANNING STUDY

APPENDIX C
THE DOWNTOWN SURFACE RAIL OPERATION

The Downtown Surface Rail Operation

To provide for an efficient rail operation along the surface of Geary between Gough and Kearny, as envisioned for Geary Corridor Alternative 4, it would be necessary to make a series of changes affecting current traffic and parking patterns. The proposed surface changes are described in the attached memorandum dated January 25, 1995, from R.M. Maxwell to G.P. Cauthen of Parsons Brinkerhoff, and illustrated in Figures C-1 and C-2.

January 25, 1995
GEARY CORRIDOR
ALTERNATIVE 4 - LRV SURFACE ALIGNMENT
GOUGH TO MASON SECTION

ASSUMPTIONS

Use Jersey City fully ADA compatible low floor LRV's, with no bridge plate required for wheelchair boardings.
Need 12 foot width for raised or shared trackway (Metro East Criteria).
Need 11 foot width for shared trackway next to station platform, and 13 feet minimum for traffic lane between station platform and curb.
The LRV surface alignment, unlike the other subway alternatives, does not include the 2 Clement bus line to provide local Geary/O'Farrell bus service east of Laguna. Consequently for this alternative we assumed a compromise 2-block stop spacing between Laguna and Kearny. Two-block car stop spacing has the potential of fitting a two-way transit street into the traffic signal timing of a one-way street grid system.
Decisions concerning right of way use were based on following priorities from most important to least important: 1) Pedestrians, 2) Transit, 3) Curb Loading and Parking Garage Access, 4) Traffic, and 5) Parking. The balance of this study concerns Items 2, 3, and 4. We assumed no narrowing of sidewalk so pedestrians (Item 1) would not be adversely impacted. Likewise, the maintenance of as much curb loading as possible would automatically provide for retention of as much of the curb parking (Item 5) as possible.

CHARACTERISTICS (See Figure C-1)

O'Farrell Street
Diamond lane would be converted to fixed flow and bus stops would be eliminated.
Geary Street
Kearny to Powell - Transit Mall. Truck loading along the south curb and trucks only on eastbound tracks. No vehicles allowed on the westbound tracks. The entrance to the Union Square Garage moved from Geary to Post Street.
Powell to Mason - Trucks allowed on east bound tracks with a loading lane along the south curb. Westbound mixed flow traffic on tracks to allow access to the St. Francis Hotel parking.
Mason to Taylor - With hotels on both sides, and theaters on the south side, loading is needed on both sides with mixed flow traffic on tracks in both directions.
Taylor to Van Ness - Mixed flow traffic on tracks in both directions with loading on both sides.
Van Ness to Gough - Trackway on south curb with no vehicles allowed on the trackway. There would be one westbound traffic lane plus one westbound peak hour tow-a-way lane.
To minimize the mixed traffic volume on the trackway, no left turns would be allowed from the trackway and all traffic would be forced to turn right every other

block. (See Detail 1.) At forced right turn locations a right turn lane would provide storage, so that right turning vehicles waiting for pedestrians in the crosswalk would not block LRV movements.

Post Street

At Montgomery - Operating Post Street westbound would improve the operations of the Montgomery Street crossing of Market Street, since Montgomery Street would have more green time.

Montgomery to Stockton on Post Street - One-way westbound with left turn lane at Stockton.

Stockton to Powell on Post Street - Two-way with one lane eastbound to provide access to the Union Square Garage from O'Farrell via Powell, and to allow exiting vehicles to use Stockton and Fourth Streets to access the Bay Bridge and Route 80. Post is 54 feet wide along this block allowing an extra lane.

Powell to Mason on Post Street - One-way westbound, with a widened south curb loading lane to allow charter buses facing west to load on the street side.

Mason to Gough on Post Street - One-way westbound, except one short eastbound lane from Peter Yorke to Franklin.

Peter Yorke Way

Due to the apartment garage and business parking lots, the 38 foot wide Peter Yorke Way would have two lanes westbound and one lane eastbound.

Sutter Street

Sutter would be a two-way street its full length to provide for loading on both sides of the street and for local circulation needs. For example, traffic southbound on Sansome Street between Bush and Sutter needs some where to go. The nature of traffic controls needed to limit traffic on Sutter was not investigated in this study.

Grant Street

Two-way between Sutter and Post to allow access to Post from Bush.

Stockton Street

Two-way between Post and Sutter to allow access to the Stockton Tunnel and to the Stockton Sutter garage from Post.

CONCLUSIONS

Overall

Two-way LRV operation along Geary Street is possible; however, it would affect significant changes to O'Farrell, Geary, Post and Sutter Streets, Peter Yorke Way, and to one-block-long sections of Stockton and Grant Streets. Among the changes would be no left turns allowed along Geary and Sutter Streets, and forced right-turns every other block off of Geary Street.

LRV Operations

LRV operations along Geary Street would require tolerance of some traffic interference and would not have full LRV traffic signal preemption.

With two-block station spacing travel speeds would improve compared to the current one-block bus stop spacing for the 38 Local, but speeds would be no better and may be worse than the 38 Limited.

Consolidating transit operations from four one-way streets to two two-way streets (Geary and Sutter) shortens walking distances.
Van Ness Corridor - Because of the heavy cross traffic and short block lengths, it is not likely that MUNI can obtain transit preferential treatment for the LRV's crossing Van Ness Avenue, Franklin and Gough Streets. Van Ness at Geary carries approximately 80,000 ADT, Franklin roughly 30,000 ADT and Gough 20,000 ADT. The Geary 38 local and Limited buses carry about 25,000 daily person trips across Van Ness.
Full traffic signal preemption for transit may trap pedestrians. This is not deemed safe for this densely populated section of Geary Street. The proposed transit preferential signaling strategy will require simulation modeling for adequate analysis.
If LRV's are to operate on the surface of Market Street, then it is essential to eliminate or reduce the number of automobiles on this section of Market Street. Also LRV stops along Market would need wider and higher platforms for full ADA compatibility.

Bus Operations

Bus operation along Sutter Street was not analyzed, but two-way bus progression with bus stops every other block may work with minimal impact on cross traffic.
Two-way bus operations on Sutter and retention of all existing curb loading would mean the loss of the diamond lanes that protect bus movements during heavily congested conditions.
Curb loading and parking impacts have been minimized as much as possible. Businesses on the south side of Geary just west of Van Ness, and on the north side of Geary between Mason and Kearny would have to load from across the street. At all other locations on Geary, truck loading would be possible on both sides of the street.

Parking garage access and egress

Sutter-Stockton Garage - There would be no change with respect to the Bush/Pine access and egress. In order for Post to replace Sutter as a westbound access and egress street, both Grant and Stockton would be two-way streets between Post and Sutter.
Union Square Garage - Converting garage access/egress from Geary to Post Geary would work to and from the south via 3rd and 4th Streets with the addition of one eastbound lane on Post between Powell to Stockton. Although egress to west via Post is similar to via Geary today, those trying to access the garage from the west may experience more congestion. With Post westbound the access route would be via either O'Farrell, Powell, and Post, or via Bush, Grant, and Post.
Ellis-O'Farrell Garage - No route change, and O'Farrell would have more capacity.

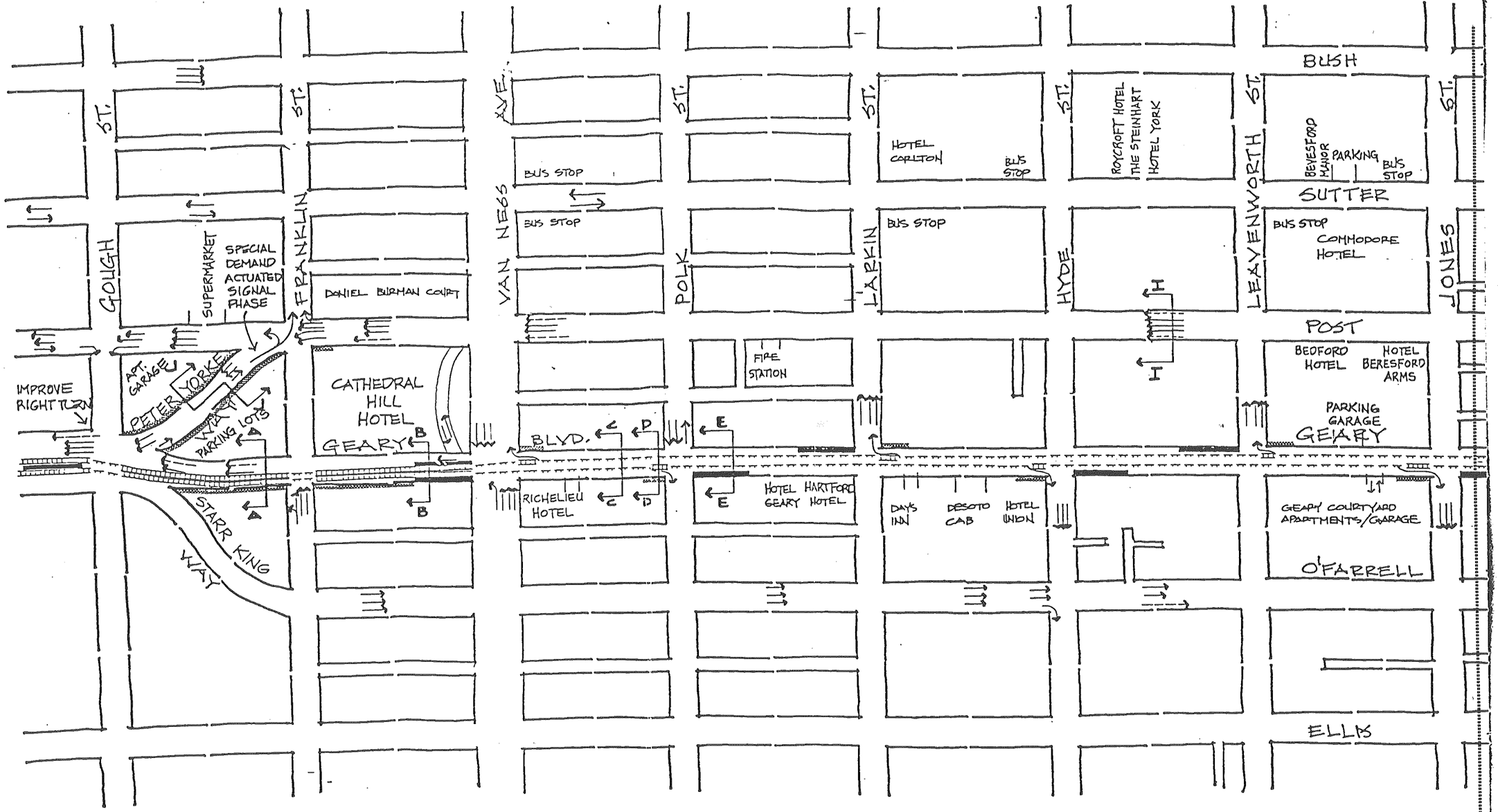
Traffic Impacts

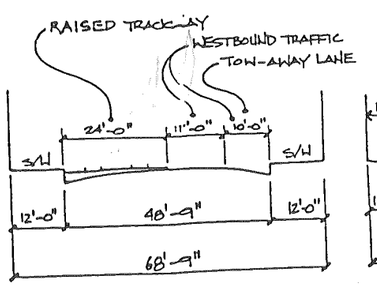
Given the small block sizes, the current one-way street grid system operates about as efficiently as is possible and any changes would potentially increase delay and reduce capacity.

- Unlike a one-way street, a two-way street can become blocked from a single double parked vehicle.

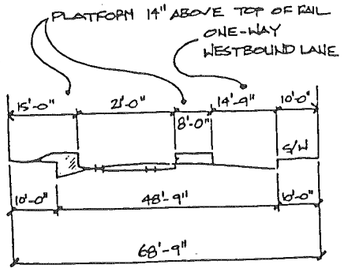
- Unlike a one-way street, a left-turning motorist on a two-way street interferes with opposing traffic.
- A one-way street grid, such as the area between Powell and Polk Streets, can have perfect traffic signal progression in all directions. Changes in the one-way grid would impact signal timing especially for cross traffic. Converting the currently one-way westbound Sutter and Geary streets to two-way transit streets would reduce westbound capacity in the PM peak. Crossing Van Ness Avenue instead of eight westbound lanes (two right-turn diamond lanes, four through lanes and two left-turn through lanes), there would be seven lanes (one right-turn-only lane at Geary, three through lanes at Post, one right-through and one left-through at Post, and one right-through lane at Sutter). Most left-turns would have to be banned from Geary and Sutter Streets, thus lengthening some circulation movements. One left turn from eastbound Sutter to northbound Kearny would be allowed and would have its own left turn lane. Significant impacts to north-south cross traffic from Polk to Mason (and possibly Gough) would occur due to traffic signal timing favoring transit along the two-way Geary and Sutter Streets.

Figure C-1

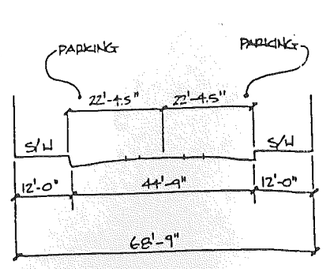




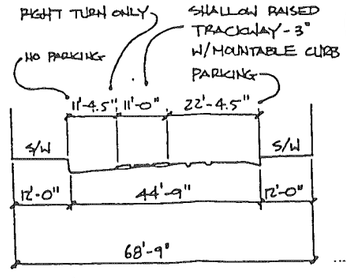
SECTION A·A
GEARY (FRANKLIN to GOUGH)



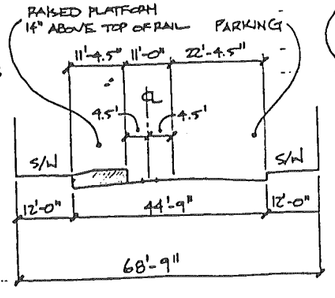
SECTION B·B
STATION @ GEARY WEST of V. NESS



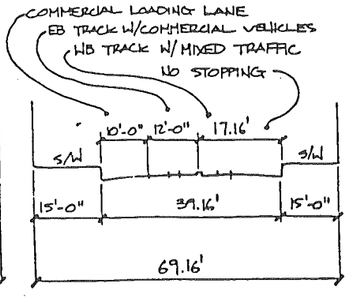
SECTION C·C
TWO WAY @ GEARY



SECTION D·D
GEARY ST.
SEE DETAIL ONE

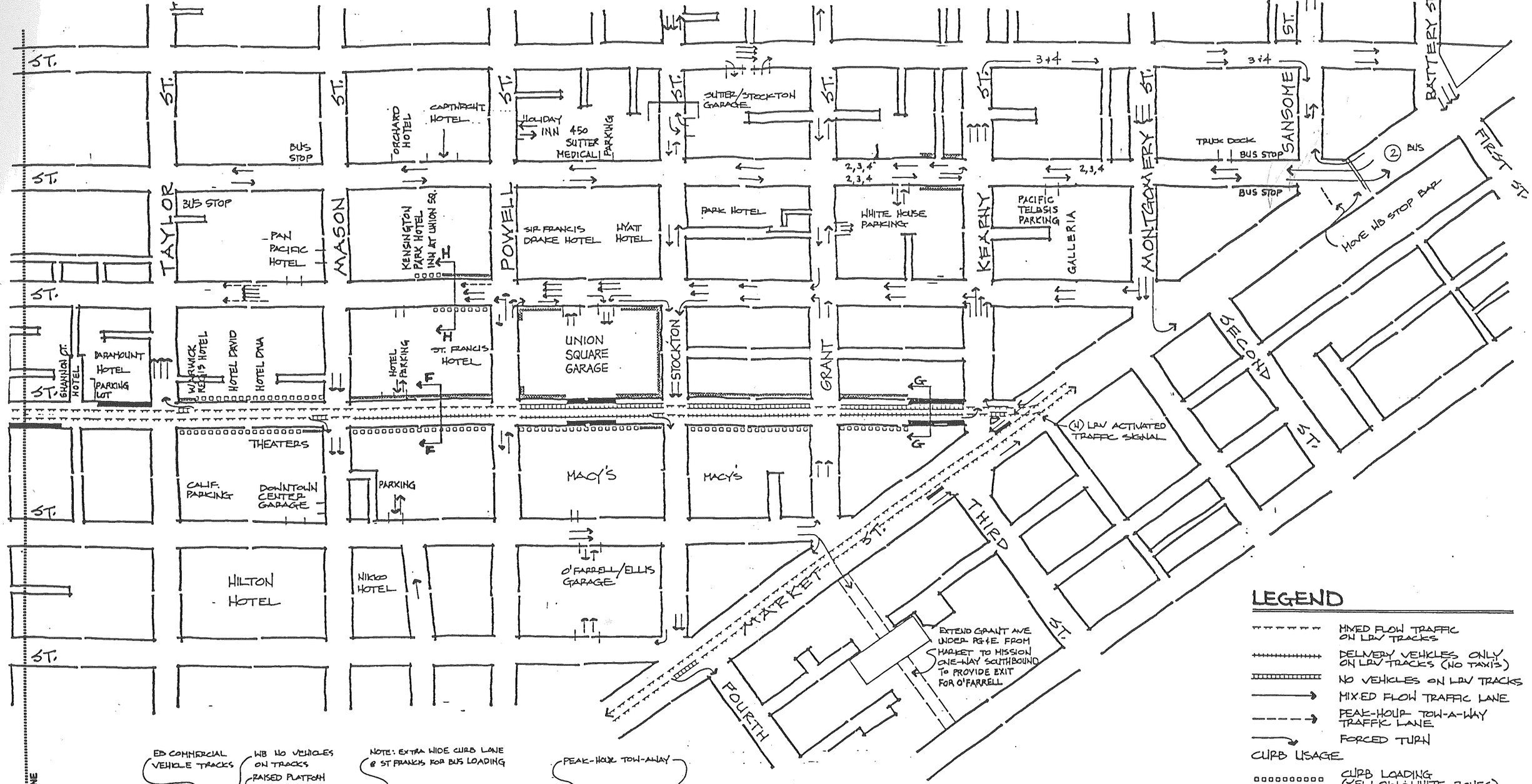


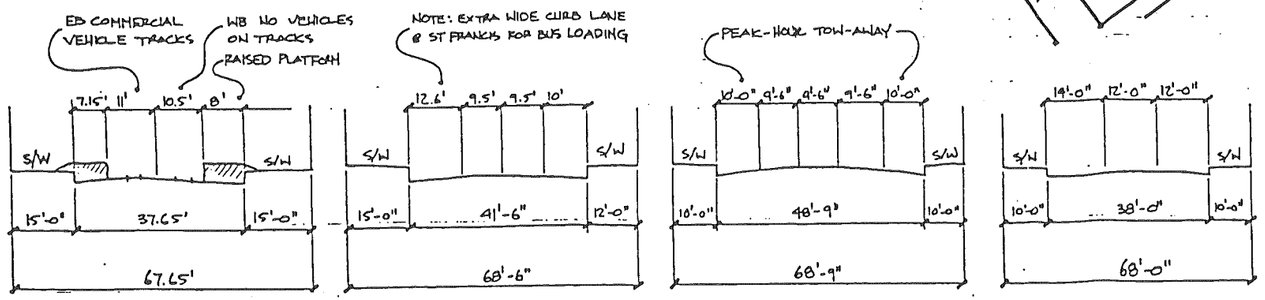
SECTION E·E
STATION @ GEARY W/ VEHICLES ALLOWED ON TRACKWAY



SECTION F·F
GEARY (POWELL to MASON)

MATCHLINE





SECTION G·G
STATION@GEARY WEST of KEARNY

SECTION H·H
POST ST. (POWELL to MASON)

SECTION I·I
POST ST.

SECTION J·J
PETER YORK WAY

LEGEND

- MIXED FLOW TRAFFIC ON LRV TRACKS
- DELIVERY VEHICLES ONLY ON LRV TRACKS (NO TAXIS)
- NO VEHICLES ON LRV TRACKS
- MIXED FLOW TRAFFIC LANE
- PEAK-HOUR TOW-A-WAY TRAFFIC LANE
- FORCED TURN

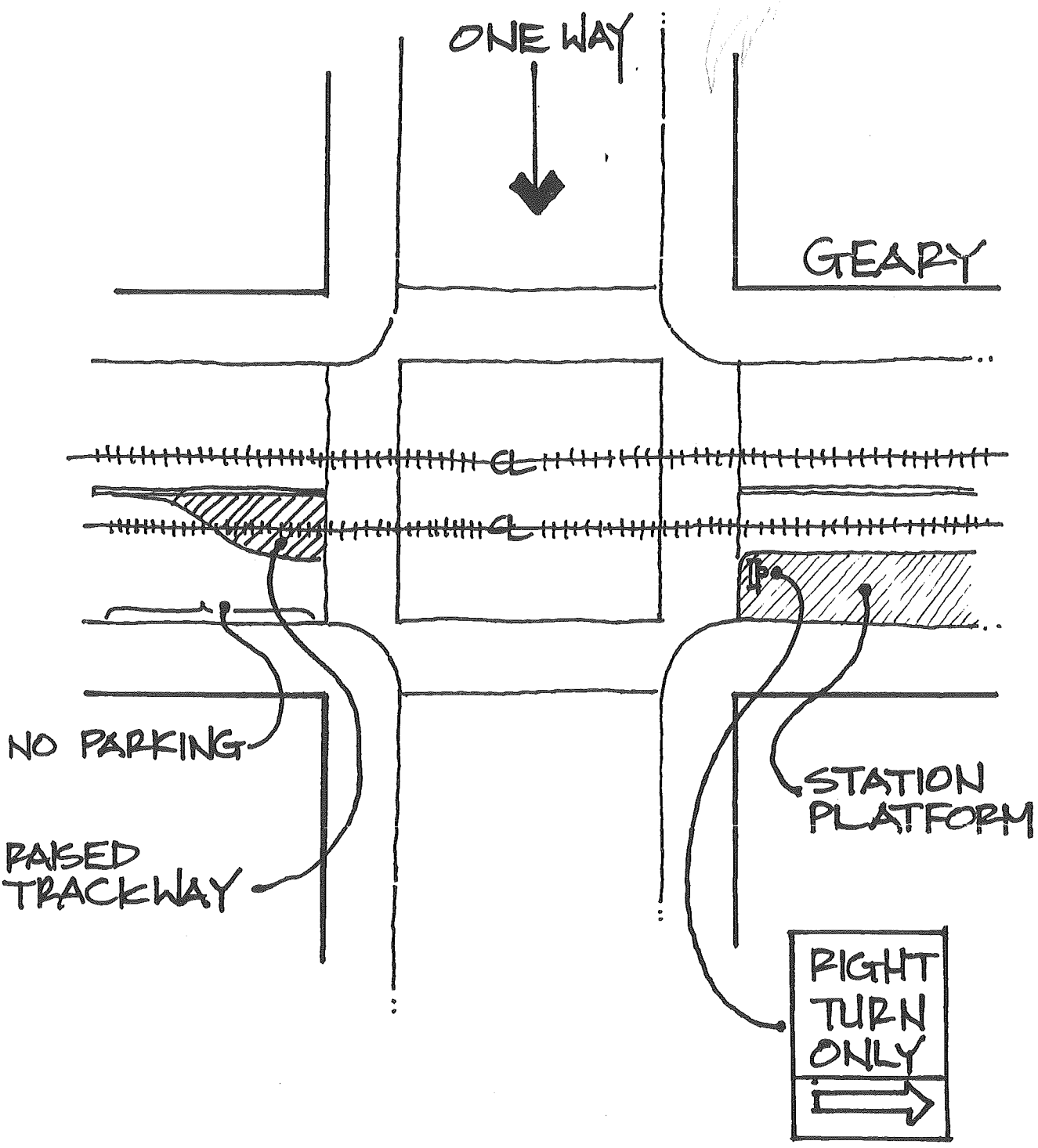
CURB USAGE

- CURB LOADING (YELLOW + WHITE BONES)
- CURB LOADING + CURB PARKING
- NO STOPPING ALONG CURB
- LRV STATION

Downtown San Francisco LRV Surface Line (Alt. 4)

0 100' 200' 300' 400' 500' 600' 700' 800' 900' 1000'

SCALE: 1"=100'-0"



DETAIL 1

TYPICAL FORCED RIGHT TURN

Figure C-2

GEARY CORRIDOR SYSTEM
PLANNING STUDY

APPENDIX D
THE OPERATING PLAN

Introduction

Operating plans are needed to form the basis of patronage forecasting and capital and operating and maintenance (O&M) cost estimating. Transit vehicle costs and therefore fleet size are important elements of a capital cost estimate. Transit vehicle miles per year and transit vehicle hours per year are key elements of an O&M cost estimate.

Fleet size requirements and miles and hours of transit service vary significantly from alternative to alternative depending upon length of route or routes as well as upon anticipated patronage, number and type of station, mode, hours of service, ingress and egress dwell times, vehicle speeds and accelerations, degree of separation from street traffic, pre–emption of signals, degree of crowding on the vehicles and other factors. These are the elements that make up an Operating Plan.

This appendix:

- summarizes the assumptions and methodology used to develop operating plans for each of the seven Geary Corridor alternatives;
- describes the four operating options developed for the Geary median included as part of Geary Alternatives 2A, 2B, 3B, 3C and 4;
- explains why Option 1 of the median operating scenarios was selected for cost estimating purposes; and
- presents the operational basis for the capital and O&M cost estimates.

Assumptions

The seven alternatives are described in Section II H of the Final Report. The operational assumptions referred to in Section II H are summarized as follows:

- routing and physical configurations as per Section II H
- for all median operation alternatives (2A, 2B, 3B, 3C and 4), one operator per train and proof–of–payment fare collection along median and subway sections; no change in current fare collection procedures for the other alternatives
- low floor vehicles for all alternatives

- LRV operating hours: 5am to midnight seven days a week; normal bus hours 5am to midnight seven days a week, plus Owl service

- signals at Geary and 8th, 18th, 27th and 30th pre–empted for all alternatives

- articulated vehicles for all alternatives

- a mixed service consisting of both dual mode and electric trolley buses for Alternative 3A; electric trolley bus service for Alternatives 3B and 3C.

- LRV service consists of one or two car trains depending upon demand. No in–line coupling is anticipated. Median stations will be 165 feet long to accommodate two car trains. Subway stations will be 350 feet long to provide for the possible deployment of longer trains if they are ever needed in the future. BART subway stations would be 700 feet long.

Methodology

As indicated in Section II H, the seven Geary alternatives selected by the San Francisco Public Utilities Commission for further evaluation are:

Alternative 1: Transportation Systems Management (TSM)
Alternative 2A: Geary/Market Light Rail Subway/Surface Line
Alternative 2B: Geary/Market/Howard Light Rail Subway/Surface Line
Alternative 3A: Electric Trolley Bus/Dual Mode Bus Subway/Surface Line
Alternative 3B: Electric Trolley Bus Subway/Surface Line (long tunnel)
Alternative 3C: Electric Trolley Bus Subway/Surface Line (short tunnel)
Alternative 4: Surface Light Rail Line

To form the basis of patronage forecasting and cost estimating, it is necessary that an operating plan be developed for each of the alternatives.

A clear definition of proposed operating plans is especially important in the Geary corridor since the implementation of a light rail or trolley bus subway/surface line on Geary would involve eliminating the 38 local and 38L limited and possibly the 38AX/BX express lines. Assuming a diversion of other MUNI patrons to a high capacity Geary trunk line service, reductions in service to such other MUNI bus lines as the 31 Balboa, 2 Clement and 1 California would also occur.

The operating model developed for this study calculates the total revenue miles and hours of rail, electric trolley, dual mode and diesel service. (Four separate operating scenarios were developed for Alternatives 2A, 2B, 3B, 3C and 4 reflecting the four options for operating in the median associated with these five alternatives; see below). In all cases, the total miles and hours of new service is adjusted to reflect corresponding reductions in existing bus service. The step–by–step process used to develop the model is summarized as follows:

1. Determine the travel time of each rail line and bus route by segment. As indicated, the travel time in a given segment is dependent upon the average speed that the transit vehicles can achieve while traveling through the segment. Table D–1 describes each of type of travel way and the average speed assumed for the travel way.

2. Calculate vehicle revenue hours (LRVs per hour or buses per hour). This was based on round trip travel times, train lengths, and on assumed frequencies of service by time–of–day period. The annual hours were calculated using the assumption that there are 253 weekdays and 112 weekend days in the year.

3. Calculate vehicle revenue miles. The revenue miles, (calculated in car– miles for the LRV alternatives), were calculated based on total one–way route miles, length of time–of–day period and assumed frequencies by time–of–day period.

4. Based on the above, determine fleet requirement.

The Median Options

As indicated, Geary Alternatives 2A, 2B and 3B incorporate a transit median along the center of Geary Boulevard between 39th Avenue and Laguna Street Portal. Alternatives 3C and 4 propose a median similar in all respects to that proposed in connection with Alternatives 2A, 2B and 3B except that instead of ending at Laguna, it extends to Gough Street. In an attempt to optimize service and minimize the effects of the median on adjacent street traffic and parking conditions, four ways of operating in a median were defined and analyzed.

Table D–1
Average Transit Speeds of Transit Travel Ways

Type of Transit Travel Way	Average Transit Speed (mph)	Source
LRT Surface – Mixed Flow near Market	5.7	MUNI #8 Market: Ferry Terminal to Van Ness/Market
LRT Subway	17.2	MUNI Metro: Embarcadero to Castro[1]
LRT Transit Mall	11.0	Sacramento RT: 8th/K St. to 12th/K St.
Median – East of Masonic[2]	15.0	Estimated: Assumes expressway operation
Median – West of Masonic[2]	10.0	MUNI N Line: 9th/Judah to 19th/Judah
Surface Mixed – Western End	10.0	MUNI #38 Limited: Mixed flow from 39th to Pt. Lobos
Diamond Lane	6.0	MUNI #38 Local: Geary/Powell to Geary/Van Ness
Diesel – Mixed Flow	8.0	MUNI #38 Local: Geary/6th to Geary/33rd
Diesel – Mixed Flow, Limited	9.6	MUNI #38L: Powell to 6th Ave.
Trolley – Mixed Flow	8.0	MUNI #1: Fillmore/Sacramento to California/Presidio
Trolley/Dual Mode Subway	15.0	Estimated: Assumes auto guidance system

[1] Closest time points are West Portal and Embarcadero; speed decreased to represent slower speed between Embarcadero and Castro.

[2] When proof of payment is assumed, median operating speeds increase by 15% for LRV and 10% for bus.

There are several possible ways of operating in the median segment. The variations affect stop spacing and therefore system access time and average operating speed. Stop spacing in turn affects the need for supplemental, mixed flow bus service on Geary. (The closer the spacing of trunk line stations approximates the spacing, the slower the average speed, and the lower the need for supplementary service). The following median options were considered:

1. Station stops every four blocks and no supplemental bus service
2. Station stops every eight blocks with supplemental local bus service
3. Skip stop operation with station stops every four blocks and no supplemental bus service.
4. Skip stop operation with station stops closer than every four blocks and no supplemental bus service.

Each of the four above–listed options affects local bus service in a different way. Table D–2 shows these interrelationships.

Table D-2
System Impacts of Median Operating Scenarios

Median Operation	Impact on Bus Operations			
	Local Bus on Geary	Reroute 2 to serve Geary/ O'Farrell and Ocean Beach	Reroute west end of 2 only to serve Ocean Beach	Shuttle from 40th Av. to Ft. Miley
Four Block All Stops		X		X
Eight Block All Stops	X		X	
Close Stop Skip Stop		X		X
Four Block Skip Stop		X		X

Selecting Median Option 1

After a through review of the four proposed options, MUNI selected Option 1 (station stops every four blocks with no supplemental bus service) for application to the other Geary Corridor alternatives.

Option 1 was selected because of the inherent disadvantages of the skip stop operation proposed in connection with Options 3 and 4, and because of the need for supplemental bus service associated with the eight block stop spacing proposed in connection with Option 2. This option was also chosen because it exhibited a significant savings in travel time, somewhere between Options 2 and 3.

With the median stations accessible from both ends of the platforms, a four block stop spacing affords approximately the same access as exists today on Geary. The relatively close stop spacing embodied in Option 1, coupled with the fact that stations can be accessed from two directions, permits the elimination of the existing sidewalk bus operation, thus greatly reducing the effect of the median on both traffic flow and parking.

Under Option 1, service on other lines would generally change as follows:

a. The 2 Clement bus would be altered to provide service along portions of Geary that would not be adequately served otherwise. As rerouted, the 2 Clement would run from its current downtown terminal at the Ferry Terminal along Market and Geary/O'Farrell to Webster Street, where it would rejoin its current route and continue along Sutter, Euclid, Clement, 33rd and Balboa to a new westerly terminal at Balboa and La Playa. This line would thus both replace the Ocean Beach branch of the 38 Line and supplement the Tenderloin area subway operation with surface local bus service.

   The 2 Clement as adjusted would provide 7 day service at headways of 10 minutes during peak periods, 20 minutes during the base and 15 minutes during weekends. Service on this line would be extended later into the evening than is currently the case, providing service until midnight when Owl service begins.

b. The Fort Miley branch of the 38 line would be replaced with a shuttle bus operating between the Veterans Hospital and an inner terminal at the 40th and Geary trunk line station. Service would be roughly comparable to the current branch line service.

Operating Plan Results

Tables D–3 and D–4 present the results of the operating plans. The information contained in the tables was used to develop the Year 2010 patronage forecasts and the capital and O&M cost estimates. Table D–5 presents the equipment for each type of vehicle in the corridor. For the "Build" alternatives, this includes supplementary diesel bus along Geary for Route 2 and any other proposed Ft. Miley shuttle operation. For "NO Build" and TSM alternatives, it includes operation of the 38 Geary Local, 38L Geary Limited, and 2 Clement. It is assumed that 38AX/BX Geary Express would continue to operate, even under the "Build" alternatives. Operating costs could be reduced by eliminating these services for alternatives 2A, 2B, 3B, 3C, and 4. Table D–6 shows the change in revenue hours and revenue miles for diesel bus as compared to the existing diesel bus service.

Table D–3
Peak Equipment Demand

Alternative	Peak Equipment Demand			
	Light Rail Vehicle	Electric Trolley Bus	Dual Mode Vehicle	Diesel Bus
Existing	—	—	—	60*
No Build	—	—	—	62*
TSM	—	—	—	58*
2A: Geary/Market Light Rail Subway	36	—	—	15**
2B: Geary/Market/ Howard Light Rail Subway	32	—	—	15**
3A: Trolley Bus/Dual Mode Surface	—	23	26	12**
3B: Trolley Bus Subway/ Surface (long)	—	43	—	15**
3C: Trolley Bus Subway/ Surface (short)	—	46	—	15**
4: Surface Light Rail Line	38	—	—	15**

* Includes bus service for the 38, 38L 38 Owl and 2 lines.
** Bus service for the 38 and 38L lines is eliminated. The 2 line is expanded. Service to Fort Miley is provided by a bus shuttle in all but Alternative 3A.

Table D–4
Annual Revenue Miles and Revenue Hours

Alternative	Light Rail Vehicle		Electric Trolley Bus		Diesel Bus[1]	
	Revenue miles (car-mile)	Revenue hours (train-hr)	Revenue miles (bus-mile)	Revenue hours (bus-hr)	Change in revenue bus miles (1)	Change in revenue bus hours (1)
No Build	---	---	---	---	43,237	5,720
TSM	---	---	---	---	61,739	2,668
2A: Geary/Market LRT Subway	1,125,576	61,797	---	---	–938,805	–118,386
2B: Geary/Market/ Howard LRT Subway	1,182,946	55,767	---	---	–938,805	–118,386
3A: ETB/Dual Mode Surface	---	---	1,140,347	133,880	–1,000,492	–113,307
3B: ETB Subway/ Surface (long)	---	---	1,289,051	111,695	–938,805	–118,386
3C: ETB Subway/ Surface (short)	---	---	1,222,610	119,677	–947,678	–118,386
4: Surface LRT Line	1,060,863	68,019	---	---	–947,678	–118,386

[1] The change in revenue bus hours and revenue bus miles are from existing revenue miles and revenue hours as provided. Existing annual revenue bus miles in the corridor are approximated at 1,337,061 miles and existing annual revenue bus hours are approximated at 181,702 hours using the calibrated operating model. The diesel bus revenue hours and miles is for services along Geary, including the 38, 38L, and 38 Owl service, 2, and proposed Fort Miley shuttle service.

GEARY CORRIDOR SYSTEM

PLANNING STUDY

APPENDIX E

PATRONAGE FORECASTING ASSUMPTIONS AND METHODOLOGY

• Introduction

Patronage forecasting was conducted under guidelines promulgated by the Federal Transit Administration (FTA) For this reason, the ridership methods and results described in this working paper follow FTA guidelines to the extent possible, given that a state-of-the-art mode-choice patronage forecasting model was not available for this study.

• Trip Tables

Patronage forecasting is based on trip tables. Trip tables are matrices that specify the number of persons traveling between any two zones in the region. The Metropolitan Transportation Commission (MTC) has developed trip tables for the nine-county Bay Area for years 1990 and 2010; these trip tables were used as the initial input in the Geary Corridor System Planning Study.

MTC's trip tables consist of 700x700 matrices containing zone-to-zone travel volumes for work and non-work trip purposes based on patronage forecasting runs assuming the Regional Transportation Plan financially constrained slate of projects.

Geary Corridor patronage forecasting was based on existing, known transit ridership volumes and travel time elasticities. In order to use the MTC trip tables, it was required that the MTC-predicated input values for number of transit person trips for the Geary Corridor be representative of actual volumes in the Corridor. The MTC trip tables provided estimated transit person trips to/from each zone, and these forecasts were evaluated against known stop-by-stop transit ridership for bus routes in the Geary Corridor. It was determined that the MTC projected transit ridership for 1990 did provide a reasonable resemblance to actual zone-by-zone ridership in the Corridor.

The MTC transit ridership forecasts were also checked with regard to 2010 values. It was determined that, while MTC trip tables projected a 6.1 percent increase in total person trips for the Geary Corridor, the transit ridership forecasts indicated fewer transit trips than for 1990. It was unclear why this reduction in transit ridership should occur despite increases in total person trips, and in some respects this result seemed unreasonable considering the large volume of Geary Corridor residents who work or travel to downtown San Francisco with its high parking costs and traffic congestion. Therefore, it was decided that the 2010 transit person trips from the MTC trip tables was not an appropriate basis for estimating project alternative ridership. Instead, transit ridership projections from the 1990 MTC trip tables were adjusted upward by 6.1 percent and this became the No-Project volumes upon which the "build" alternatives were evaluated.

After verifying the MTC data, adjustments were made to the structure of the MTC trip tables. Due to the need to accurately measure the changes in travel time for

a corridor with at least three primary east-west arterials (Geary, California, and Balboa) where only one of the arterials was to gain improved transit services, it was necessary to disaggregate the rather large zones used by MTC into smaller zones. The 21 MTC zones in the Corridor were disaggregated into 38 new, smaller zones for use in the ridership estimation process. The 38 zones were organized around the three primary arterials, so that zones 1-14 were within walking distance of Geary Blvd., zones 18-25 were within walking distance of California Street, and zones 30-38 were within walking distance of Balboa Street. Zones 15-17 and 26-29, as well as zones 39-42, were not disaggregated as they represented the inner part of the Geary Corridor (east of Van Ness) and MTC zone sizes were adequate in this part of the Corridor. Zones outside of the Geary Corridor were aggregated into larger zones than MTC's system because of less need for detailed information in remote areas with no transit improvements proposed. Areas outside of San Francisco (zones 54-59) were aggregated at the county level or larger, and areas within San Francisco but outside the Geary Corridor (zones 43-53) were either left unchanged, or were aggregated into zones roughly resembling San Francisco districts (e.g. North Beach or South of Market) or larger areas.

The results of this exercise were customized Geary Corridor trip tables with 59 zones for work and non-work trip purposes. The Geary Corridor was represented by 42 of these zones, 11 zones covering the rest of San Francisco, and 6 zones representing areas outside of San Francisco.

- **Estimating Travel Time Differences**

Travel time elasticity means that for every "X" percent change in total transit travel time (including any out-of-vehicle time) for a given trip, there would be a "Y" percent change in travel ridership. The first part of the exercise was to identify both existing transit travel times and travel times for each project alternative so that the percent change in travel time could be measured.

Transit travel times were divided into seven categories as follows:

- Initial Access Time (Origin)
- Initial Wait Time (Initial Boarding)
- Transit Travel Time (Corridor Trunkline)
- Transfer Wait Time
- Transit Travel Time (Corridor Perpendicular Routes)
- Transit Travel Time (Outside Corridor)
- Egress Time (Destination)

Values for the above travel time components were measured for each of the zone pairs in the trip table. For the existing transit services, initial access time at trip origin and egress time at the destination was determined by considering zone centroid locations and spacing of stations (or boarding points). Wait times for both the initial boarding and for transfers (if needed) were always one-half of

the headway for each transit service. Transit travel times on corridor trunklines and corridor perpendicular routes were based on actual travel times as stated in MUNI's public timetables. Finally, travel time for segments of the trip outside of San Francisco were based on travel times on regional carriers (e.g. CalTrain or BART) between San Francisco and the centroid of the external zones. The various travel time components were placed in seven linked Lotus 1-2-3 worksheets and summed to provide a total transit travel time for each zone pair.

The determination as to the correct transit travel time for each zone pair was somewhat subjective in nature because there was typically more than one transit path that could be used. In general, the transit travel time path with the fewest transfers was used. This, in virtually all cases, was also the transit path that had the lowest overall travel time. If two transit paths had the same number of transfers, the fastest of the two paths was used.

Operating plans were developed for the TSM and each of the five "build" alternatives. Each plan described station spacing and/or location, alignment, and transit travel time. This information was used to develop travel time adjustments affecting each of the alternatives.

- **Estimating Transit Ridership**

Once transit travel times are defined, it is a straightforward matter to apply a selected elasticity value to existing transit ridership and thereby estimate the resulting new ridership volumes. For this study, an elasticity value of -0.3 (i.e. for every 10 percent decrease in transit travel time, there would be a 3 percent increase in ridership) was tested and subsequently adopted for use.

Available data was checked to determine if an elasticity of -0.3 should be applicable to the situation in San Francisco. While additional MTC model runs with different transit networks would have been ideal for evaluating the elasticity factor, model runs were not available for this study. Therefore, the validity check involved looking at different origin zones located at about the same distance from the destination zone, but with different transit travel times, to see if this resulted in a shift in transit mode split. The result of this check was a determination that an elasticity of -0.3 was probably too high for trips totally within San Francisco city limits. The fact that MTC-predicated ridership did not vary exactly with transit travel times indicated that other significant factors were present, such as parking costs or auto availability. Also, the existing system's high mode split for origins and destinations entirely within San Francisco led to the conclusion that the decision to use or not use transit for these trips was as much a matter of economics and life style choice as it was a matter of travel times. Therefore, the elasticity for intra-San Francisco trips was adjusted downward to -0.25. (For trips with one trip end outside of San Francisco, the -0.3 elasticity factor was retained.)

With both existing transit ridership and elasticity values specified, it was then possible to calculate the forecasted transit person trips for each project alternative.

In addition to estimating transit person trips (linked trips), transit boardings (unlinked trips) on the new transit services along the Geary Corridor were also calculated. Boardings reflect both the initial boarding and all subsequent transfers, and so are not a true reflection of the benefit of a particular project. However, they are needed to determine transit vehicle loading and the amount of service (transit headways) required to meet the predicted demand. Boardings on the Geary lines were estimated by determining which zone pairs would realize a travel time benefit from implementation of a particular alternative. Person trips between any zone pair that did benefit, and for which the travel times meet the criteria stated above (e.g. minimal number of transfers), were assumed to ride the new service.

- **Estimating Transit Travel Time Savings**

Transit travel times savings is used as input to the FTA Cost-Effectiveness Indices (CEI) calculations. There are two CEI's currently defined -- the New Rider Index and the User Benefit Index. Each requires calculating how much transit travel time would be saved under each project "build" alternative by those trips that used transit in the TSM Alternative. The User Benefit CEI also considers the travel time of new riders by estimating their "economic surplus" or "shadow price" related to the transit trip taken.

For the New Rider CEI, travel time savings are stated as a dollar value representing the value of the time saved. Per FTA guidelines, time is valued at $4.80 per hour for work trips and at $2.40 per hour for non-work trips. Time elements are not weighted for this purpose.

For the User Benefit CEI, travel time savings is stated as the number of hours saved, with extra weighting applied to certain categories of time. Savings in out-of-vehicle time (OVT) is weighted double for TSM transit riders. For new riders, OVT is weighted double and in-vehicle time (IVT) is not weighted, but the resulting sum of these two values is halved.

Travel time savings were calculated by subtracting travel times for each zone pair under each "build" alternative from the TSM alternative, and then multiplying the result by the appropriate number of transit riders predicted.

For additional information about the development of Cost-Effectiveness Indices, see Section III A, 2, in the report.

GEARY CORRIDOR SYSTEM
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APPENDIX F
ENVIRONMENTAL EFFECTS

ENVIRONMENTAL EFFECTS

Based on the preliminary environmental review of potential environmental impacts of each of the seven alternatives, it was determined that several have the potential for adverse environmental impact. Of primary concern are land use/physical changes; visual impacts; socioeconomic effects; transportation/circulation changes; geological conditions; exposure of hazardous substances and potential interference with emergency response; and impacts on landmark, historic, and architecturally significant buildings. Following are potential impacts, and possible mitigation measures, associated with the major areas of concern.

Land use/physical changes: Construction and operation of short viaduct segments are associated with alternatives 2A, 2B, 3B, 3C, and 4. Portals are required in alternatives 2A, 2B, 3A, 3B, and 3C, which involve subway segments. Disruptions to business and interference with residential activities can be anticipated during construction of the viaducts and portals. During operation, they could be perceived to disrupt the neighborhood character both in terms of activity and physical space, and could reduce the number of traffic lanes and on street parking. A mode shift to transit could result from reduction in vehicular capacity, and could compensate for any potential traffic congestion as a result of the project.

Visual impacts: The alternatives requiring viaduct segments, 2A, 2B, 3B, 3C, and 4, could create short physical barriers, effectively dividing the north and south sides of Geary at the viaduct locations. Existing views would be interrupted, and the existing clear air space would be obstructed. Portals required for the alternatives with subway, 2A, 2B, 3A, 3B, and 3C, could be perceived as having visual impacts on the ground. Overhead electric wiring required for both light rail vehicles (LRVs) and electric trolley buses would change the visual character of neighborhoods, and would be more pronounced in the case of electric trolleys. Mitigation measures would include design measures that would reduce or eliminate some of the vision obscuring characteristics; and design of visually appealing structures.

Socioeconomics: Businesses would be temporarily but adversely affected due to surface construction, by traffic and sidewalk circulation disruption, temporary rerouting of transit, possible loss of curbside parking, noise and vibration. Businesses on adjacent streets could also be affected, to a more limited extent, because of increased traffic congestion and greater demand for on-street parking. Portal and viaduct locations could also result in permanent impacts related to new parking constraints and traffic changes. In mitigation, residents and business along the project route could be notified of construction scheduling along street segments. Unneeded bus zones would be restriped to provide more parking.

Transportation/Circulation: Construction would cause disruptions in transportation and circulation. The cut and cover construction required in the connection with the subway portions of Alternatives 2A, 2B, 3A, 3B, and 3C would eliminate one or more lanes of traffic during the construction period. Alternatives 2A, 2B, 3A, 3B, 3C, and 4 would require up to 3.5 years for completion; however, construction impacts and time in a given block would be much less. Traffic congestion would increase on the affected streets, and more traffic would be added to adjacent streets. All alternatives except Alternative 1 would have adverse effects on traffic circulation during construction. Traffic congestion and disorientation by travelers could potentially increase safety risks. A number of signage, traffic management, and construction technique and scheduling measures could be taken to mitigate the disruptive impacts of construction.

Permanent impacts related to LRT or electric trolley bus construction (alternatives 2A, 2B, 3A, 3C and 4), viaduct operation, or any exclusive right-of-way use could result in permanent reduction of traffic lanes or require sharing of lanes. Loss of on-street parking, as well as an increase in potential conflicts between transit vehicles, motorists, bicyclists, and pedestrians, may occur where stations, stops, viaducts, and portals are proposed for alternatives 2A, 2B, 3A, 3B, 3C, and 4.

Geological conditions: Subsurface work could potentially compromise building foundations, and could require dewatering, displacement of soils, or other changes to subsurface conditions. Settlement of both older and modern buildings could result. Dewatering and other construction activity in the downtown area could have short-term impacts on availability of groundwater as a non-potable water source. Depending on conditions, 24-hour a day tunneling operations close to the surface has the potential to cause vibration impacts on surrounding structures and inhabitants. Selecting the proper tunnel boring equipment and techniques would require extensive geo-technical investigations prior to construction. Mitigation measures involve preparation work for tunneling, engineering protocols for monitoring subsurface conditions, and possibly relocating subway alignments to avoid major settlement impacts. A detailed site-specific geologic/geotechnical investigation would be conducted for the selected alternative by a qualified geotechnical consultant, who would make specific determinations of required mitigation.

Hazards: Due to past industrial activities, buried earthquake debris, and Bay fill material, there is evidence of hazardous substance contaminated soils in the downtown and south of Market areas. Construction related to alternatives 2A, 2B, 3A, 3B and 3C could expose workers and the general public to soil contamination and other buried hazards. Other areas may contain contaminants originating from leaking underground storage tanks, such as at current and former gas station sites in the western Corridor. Excavation work implicit in alternatives other than Alternative 1 could disturb soils bearing toxics. Proper disposal of such soils, at classified landfill sites, is expensive. Mitigation

measures may include soil and groundwater monitoring, protective measures for construction workers, air monitoring, dust control, and soil disposal off-site. Alternative emergency routes and notification to the appropriate authorities of Corridor construction would be provided.

Cultural and historical resources: Landmark, historic and architecturally significant buildings could be adversely affected by subsurface changes, especially those that have not been upgraded to current engineering and seismic standards. Many of these buildings have decorative features that could be compromised by subsurface work and/or vibrations during construction. Measures to mitigate potential impacts to structures may include bracing and other reinforcement of the buildings. Pre-construction surveys would be performed on all structure types along the construction route to note the existing condition of the structures. Limited work stoppage could be called for. Vibratory hammers, as opposed to impact hammers, could be used for pile driving where soil conditions permit. Subsurface excavation for alternatives 2A, 2B, 3A, 3B and 3C could also affect historic and prehistoric resources that may exist, such as shell mounds south of Market Street, 19th century ship remains, or prehistoric animal remains. Measures to mitigate potential impacts to archaeological resources may include expert compilation of archaeological archival reports, preconstruction testing, and construction site monitoring.

Noise: Construction would be carried out using the best available noise control techniques in order to minimize noise impacts. Periodic monitoring of noise at the construction sites could be included in the environmental compliance monitoring program. Residents and businesses would be notified of construction scheduling. In residential areas, operation of heavy equipment could be limited to daytime working hours, and project-related truck operations could be prohibited at nighttime unless a non-residential haul route could be selected. Stationary noise sources could be located as far from adjacent residences, hospitals, schools, and libraries as possible.

Air quality: A mitigation program could be implemented to insure that dirt spills from construction onto the adjacent traveled roadway are minimized. Dust suppression using water could be applied during excavations, soil loading, hauling, and temporary stockpiling. Stationary motor sources would be equipped with supplementary pollution control systems, if required by the Bay Area Air Quality Management District. No mobile source should be left idling for more than 10 minutes in any one location.

GEARY CORRIDOR SYSTEM

PLANNING STUDY

APPENDIX G

DEVELOPING THE FOUR RECOMMENDED ALTERNATIVES

On February 3rd, 1995, the Study Team, consisting of representatives of MUNI, the Department of City Planning, the Department of Parking and Traffic, the Bay Area Rapid Transit District, and the Consultant, met to review the seven alternatives developed for the Geary Corridor System Planning Study.

Based upon the results of the Study, and with consideration given to comments received during the Public Participation Program, the Study Team reached a number of agreements. Following is a summary of the agreements reached at the meeting:

It was generally agreed that the BART alternative could be made to work with any of the Geary Corridor alternatives and that, in any event, the presence of a BART subway serving a portion of the Corridor would not significantly reduce the need for an upgraded Geary Corridor MUNI service. It was also agreed that there were other San Francisco BART routes deserving of consideration. Language reflecting these ideas has been included in the BART Alternative Report.

It was agreed that the Geary Corridor, because of its heavily used east/west bus lines, warrants a major investment to produce a significantly speeded up and otherwise improved MUNI light rail or electric trolley bus system.

The advancement of the following Geary Corridor alternatives into the next phase of the MUNI development process is considered justified based upon the trip time, ridership and cost information developed in the Geary Corridor System Planning Study.

- **The "No Build" and Transportation Systems Management (TSM) alternatives**, since they provide the basis of comparison necessary to evaluate "build" alternatives.

- A **light rail, subway/surface alternative**. The options include Geary Corridor Alternative 2A (subway from Laguna to Market; surface on Market), Geary Alternative 2B (subway from Laguna to Beale and Howard), and a third alternative featuring a subway from Laguna to the foot of Bush or Pine Street. (The sophisticated patronage modeling associated with FTA Major Investment Studies, together with refined capital and O&M cost estimates, would provide a good basis for comparing the three above-listed options).

- An **electric trolley bus, subway/surface alternative.** Depending upon cost and neighborhood input, the subway portion of this line should run either from Laguna to Beale and Howard (Geary Corridor Alternative 3B) or from Taylor to Beale and Howard (Geary Corridor Alternative 3C).

- Given the support expressed in recent public meetings favoring a relatively inexpensive rail solution to Geary Corridor transportation problems, and the

limited funding available, an **alternative featuring an all-surface light rail line on Geary** (Geary Corridor Alternative 4).

It was also agreed that Geary Corridor Alternative 3A (with buses traveling in mixed flow traffic west of Laguna) should be dropped from further consideration because the travel times saved are insufficient to justify the capital cost of development.

As a result of its independent assessment of the four above-described alternatives, the Consultant made the following additional comments and recommendations:

1) In the interest of incorporating proposals developed in related studies (in this case the Citywide Rail Study), the Bush/Pine option has been added to Alternative 2. It is emphasized that no information about the Bush/Pine option was developed as part of the Geary Corridor System Planning Study.

2) In view of its significantly lower capital cost and its apparent acceptance by those participating in the Public Participation Program, the surface rail alternative (Alternative 4) deserves consideration in the MIS phase. Based upon our analysis, it is clear that any proposal involving a downtown rail service on Geary (or on any of the streets parallel to Geary) would require a major reorganization of current downtown traffic and street patterns.

3) Alternative 2B is routed along Howard Street. In view of information recently received indicating that the build-out of the South of Market area is projected to occur over a long period of time, it will in all likelihood be many years before the main part of the Downtown Area envelops the east end of Howard Street. Given this factor, a Mission Street alignment may prove more useful to more people than a Howard Street alignment. For this reason, it may be appropriate to introduce the Mission Street option during the MIS phase.